THE

JOURNAL OF GAS LIGHTING,

WATER SUPPLY, & SANITARY IMPROVEMENT.

[Registered as a Newspaper.]

Vol. XXIV. No. 585.] LONDON, JULY 28, 1874. [26th Year.] Price 6d.

RAMSAY'S NEWCASTLE CANNEL
COAL. Analysis—10,000 cubic feet of gas per ton of coal; 26-candle gas; 13¼ cwt. coke per ton of coal.
The London Exhibition in 1851 was lighted with gas made from Ramsay's Cannel.
RAMSAY'S PATENT CONDENSED COKE.
DO. GARESFIELD COKE.
RAMSAY'S FIRE-CLAY ARTICLES.
GAS-RETORTS, introduced 1828. FIRE-BRICK WORKS, established 1804. FIRE-CLAY SANITARY PIPES, CHIMNEY-TOPS, and all Goods made of Fire-Clay. The Fire-Clay is worked from Blaydon Main Colliery, is of excellent quality, and no expense spared in perfecting every article. The FIRE-BRICKS (marked "RAMSAY") are to be seen in all parts of the world, and the Works are the most extensive in the Kingdom.
Manufactories—Derwenthaugh, Swalwell, and Hebburn Quay, near Newcastle-on-Tyne; and London Wharves—Falcon Wharf, No. 80, Bankside; and Honduras Wharf, Cubit Town. Large stocks kept.
Address G. H. Ramsay, Newcastle-on-Tyne.

GENUINE TORBAY PAINT
AND
SPECIAL GASOMETER PAINT
(Mixed ready for use).
FOUR PRIZE MEDALS.
WORKS: BRIXHAM, TORBAY.
These Paints are now used in 100 Country Gas-Works, and by all (but one) of the London Gas Companies, on Gasholders, Scrubbers, Purifiers, &c. They will cover tar effectually. Also used by the Admiralty, War Office, Railway Companies, Founders, &c.
They prevent and arrest rust, and protect iron from the action of water, sulphurous and gaseous exhalations.
The covering powers are considerably greater than those of any other Paint.—*See "Engineer," Nov. 2, 1866.*
STEVENS AND CO.,
London Office, 21, Great Winchester Street, E.C.

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PATENTEE & CONTRACTING GAS ENGINEER
FOR
SETTING RETORTS,
ERECTING AND REMODELLING
GAS-WORKS OF ANY EXTENT,
AT HOME OR ABROAD.
Address—
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COWEN'S PATENT FIRE-CLAY RETORTS.
JOSEPH COWEN and CO.,
BLAYDON BURN, BLAYDON-ON-TYNE,
Were the only parties to whom a Prize Medal was awarded at the Great Exhibition of 1851, for "Gas-Retorts and other Objects in Fire-Clay," and they were also awarded at the International Exhibition of 1862, the Prize Medal for "Gas-Retorts, Fire-Bricks, &c., for Excellence of Quality."
J. C. and Co. have been for many years the most extensive Manufacturers of Fire-Clay Retorts and Fire-Bricks in the Kingdom. Orders for Fire-Clay Retorts of all shapes and dimensions, and to fit any shaped Mouthpiece, Fire-Bricks, and every other article in Fire-Clay, are promptly executed at their Works as above.
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Coal Office,
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Jos. Cowen & Co. are the only Manufacturers of Fire-Bricks and Clay Retorts at Blaydon Burn.

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THE OLD TUBE-WORKS, WEDNESBURY
AND
THE ALMA WORKS, WALSALL,
Established at the commencement of Gas Lighting.
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COMMERCIAL STREET, SPITALFIELDS; 5, CHARLES STREET, SOHO; and 16, SOHO SQUARE, } LONDON
35, 36, 37, & 39, GRANBY-ROW, MANCHESTER.
J. R. and Co. are the original manufacturers of Wrought-Iron Gas Tubes and Fittings, and Inventors of the LAP-WELDED TUBES for Locomotive and Marine Boilers.
J. R. and Co. make all kinds of Tubes and Fittings for Gas, Steam, and Water; Gun-Metal Cocks, Stocks, and Dies; Galvanised Tubes and High-Pressure Tubes, &c.
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CAST & WROUGHT IRON TANKS FOR DITTO,
And Gas Apparatus of every Description.
Marine, Tubular, Cornish, Plain, Furnace, Saddle, and Range Boilers.
Sugar, Saltpetre, and all kinds of Pans.
Roofs, Girders, and Bridges, and General Smith's Work.
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J. & W. ROMANS, Consulting Gas Engineers and Coal Factors, of Edinburgh and London, CONTRACT for supplying any quantity of COAL and CANNEL.
They are also Contractors for leasing Gas-Works, for supplying, erecting, or repairing gas apparatus and fire-clay goods.
Messrs. Romans, being lessees of several Gas-Works, have their Cannels tested in the ordinary working process, thus securing for their customers a guarantee beyond mere laboratory experiments.
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Coal, machinery, fire goods, &c., shipped to all parts of the world.

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For the English Government, and for the Government of the Netherlands;
MAKERS OF THE DUPLICATE COPY
Presented by Her Majesty's Government to the French Government;
AND MANUFACTURERS OF
IMPROVED
DRY GAS-METERS,
Warranted to Measure correctly, and not to vary.
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236, GEORGE STREET, GLASGOW; and 15, MARKET STREET, MANCHESTER.

G. G. and Co. have just received the only Medal awarded for Gas-Meters at the Vienna International Exhibition.

SILVER MEDAL, PARIS EXHIBITION, 1867.

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Boiler-Tube Ferrules, Gun-Metal Gland Cocks, Water-Gauges, Whistles, &c.; Stocks, Taps, and Dies for Screwing, and Gas-Fitters Tools.

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AND EVERY DESCRIPTION OF FIRE-CLAY GOODS.

N.B.—A Stock of 15 and 16 in. CIRCULAR RETORTS always on hand. Other kinds made to order on short Notice.

CAFFALL, THOMAS, & CO., LIMITED.

PATENT IMPROVED SEAL

FOR

GAS HYDRAULIC MAINS.

SAVES COAL, RETORTS, FUEL, LABOUR, TIME, SPACE, AND CAPITAL.

PREVENTS STOPPAGE OF ASCENSION-PIPES, DEPOSITION OF CARBON IN RETORTS.

GIVES MORE GAS, WITH HIGHER ILLUMINATING POWER, SATISFACTION, AND PROFIT TO SHAREHOLDERS AND MANAGERS.

IS STRONG, SIMPLE, EASILY FIXED AND WORKED, AND THOROUGHLY EFFICIENT AT ALL TIMES.

TESTIMONIAL.

Alton Gas and Coke Company, Alton, Hants, April 25, 1874.

GENTLEMEN,—In reply to your inquiry respecting your Patent Dip for Hydraulic Gas-Mains in use at these works, I beg to say that, upon looking into our carbonizing account for the last 12 weeks, and comparing the result with the same quarters of the past five years, I find that your Dip has given our Company an increase of 1286 feet of gas per ton of coals beyond the makes in the other years, notwithstanding the retorts have been in use for three years.

I may say that our Company are so satisfied with the Dips that it is intended to fit up the other retorts with them this summer.

I am, gentlemen, your obedient servant,

Messrs. Caffall, Thomas, and Co., Limited, 28, Gracechurch Street, E.C. WM. TRIMMING, Secretary.

Models may be seen, and information obtained, at the Offices, 28, Gracechurch Street.

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THE MEDAL FOR 1862.

The only Prize Medal awarded for TUBES & FITTINGS.

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GAS-FITTERS TOOLS, VALVES, COCKS, &c.

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CAST & WROUGHT IRON TANKS FOR DITTO;

PURIFIERS, CONDENSERS, SCRUBBERS, RETORTS, VALVES;

IMPROVED WROUGHT-IRON RETORT-LIDS, CROSS-BARS, & SCREWS;

AND GAS APPARATUS OF EVERY DESCRIPTION.

SOLE MANUFACTURERS OF LIVESEY'S PATENT GASHOLDER MAN-LID,

By use of which Man-lid, inlet and outlet pipes can be examined and cleansed without loss of gas in crown of holder, or ingress of atmospheric air.

ROOFS, GIRDERS, BRIDGES, AND BOILERS OF ALL KINDS.

Drawings, Specifications, and Estimates supplied on application.

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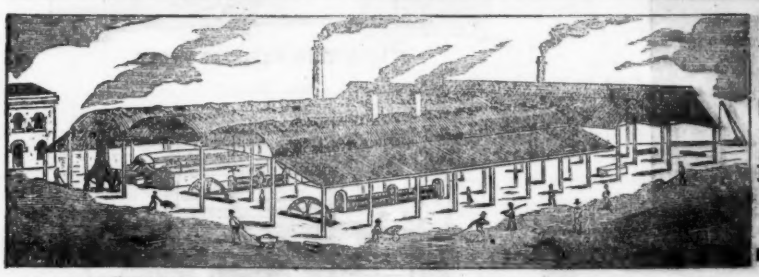
FOR GAS, STEAM, AND WATER;

Also ORDINARY WELDED WROUGHT-IRON TUBES and FITTINGS,

FOR GAS, STEAM, & WATER, EITHER BLACK, GALVANIZED, OR ENAMELLED.

CORE BARS FOR IRONFOUNDERS, STOCKS, TAPS, AND DIES, IRON COCKS, &c.

London Agent—W. G. DAVIS, 2, Brabant Court, Philpot Lane, E.C.



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GALVANIZED CORRUGATED CURVED IRON ROOFING, WROUGHT-IRON FRAMED ROOFING, IRON BUILDINGS

OF EVERY KIND.

WROUGHT-IRON TANKS, WROUGHT-IRON PIPES & TROUGHS, & GENERAL WROUGHT IRON WORK.

I. D.'s CORRUGATED CURVED SELF-SUPPORTING IRON ROOFS are specially suitable for Forges, Rolling-Mills, Iron-Works, Shipbuilding Yards, Mines, Collieries, Gas and Water Works, and for general purposes.

For Roofs with Timber Framing, I. D.'S GALVANIZED OR PAINTED CORRUGATED SLATES OR SHEETS form a durable and cheap covering, costing only about the same, when fixed complete, as felt and boards.

DRAWINGS AND ESTIMATES ON APPLICATION.

HODGE & CO.'S

IMPROVED VENTILATING SUN-LIGHTS

WITH TALC REFLECTORS AND SELF-ACTING VALVES

TO PREVENT DOWN-DRAUGHT;

VENTILATING GLOBE LIGHTS for DINING-ROOMS, LIBRARIES, &c.

Ormolu, Bronze, & Crystal Gaseliers;

MEDIÆVAL CHURCH WORK AND CORONÆ

COCKS, VALVES, and FITTINGS for GAS, STEAM, and WATER;

COLUMNS, BRACKETS, & STREET LANTERNS;

BLACK AND GALVANIZED BARREL COMPO AND TIN PIPE.

GAS ENGINEERS,

100, HATTON GARDEN, LONDON.

Drawings and Prices upon application.

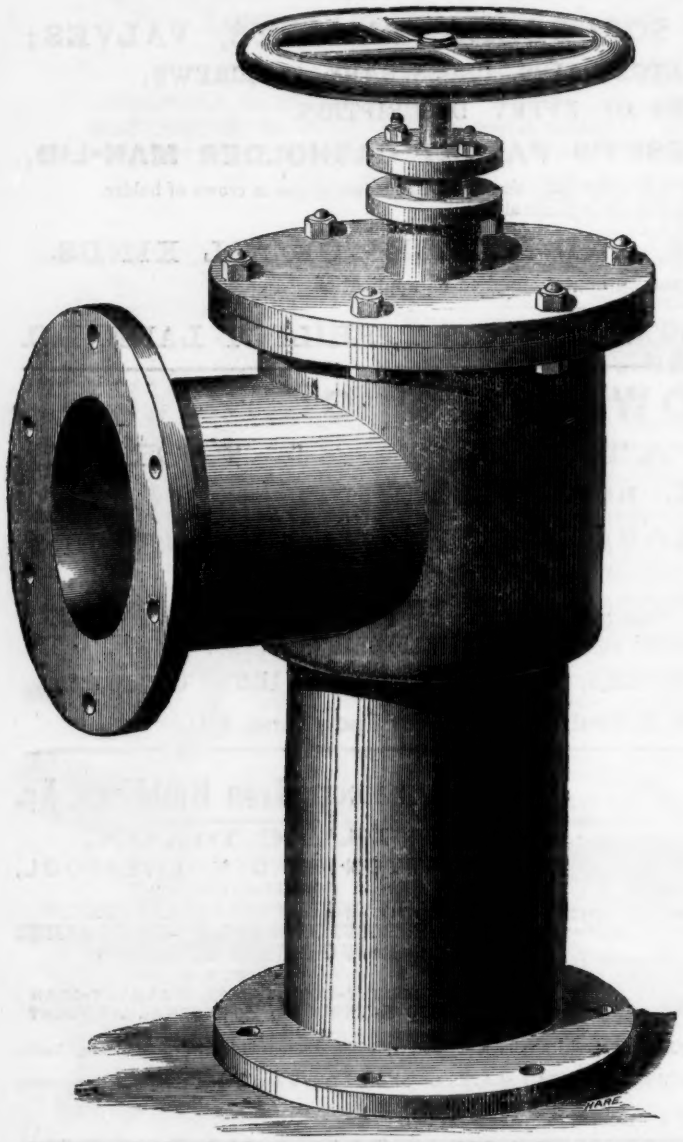
GEORGE WALLER & CO.,

GAS ENGINEERS AND CONTRACTORS,

MANUFACTURERS OF

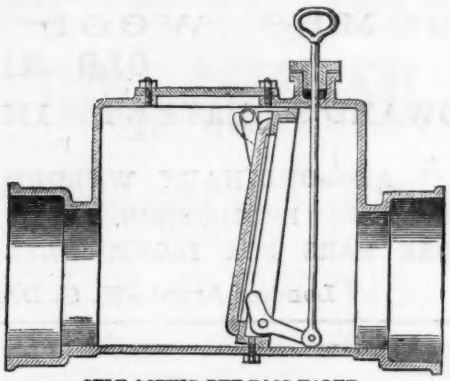
BEALE'S IMPROVED PATENT GAS-EXHAUSTERS,

COMBINED ENGINES AND EXHAUSTERS.

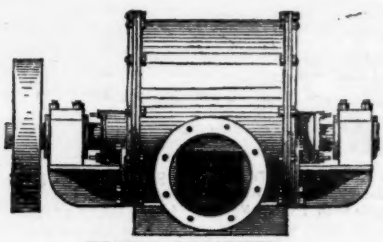


DISC GAS-VALVE.

These Valves have been specially designed by G. Waller and Co. for Beale's Exhausters. They are most effective in action, and have given universal satisfaction. They can also be made with spigot at base, to suit ordinary socket connexions.



SELF-ACTING BYE-PASS VALVE.



BEALE'S EXHAUSTER.

PUMPS, VALVES (2 in. to 30 in.), HYDRAULIC REGULATORS, ENGINES, &c., in STOCK.

PHŒNIX ENGINEERING WORKS, HOLLAND STREET, SOUTHWARK, S.E.,

AND AT

STROUD, GLOUCESTERSHIRE.

JAMES GREGORY AND SONS,

MANUFACTURERS OF EVERY DESCRIPTION OF

STEEL TOOLS FOR GAS & WATER WORKS.

All-Steel Charging and Stoking Shovels, Coke Screens and Forks, Steel Scoops, Picks, Mattocks, Axes, Trowels, &c.

WELDING STEEL RAKE AND SPUD HEADS.

Corporate Mark SOHO Granted 1763.

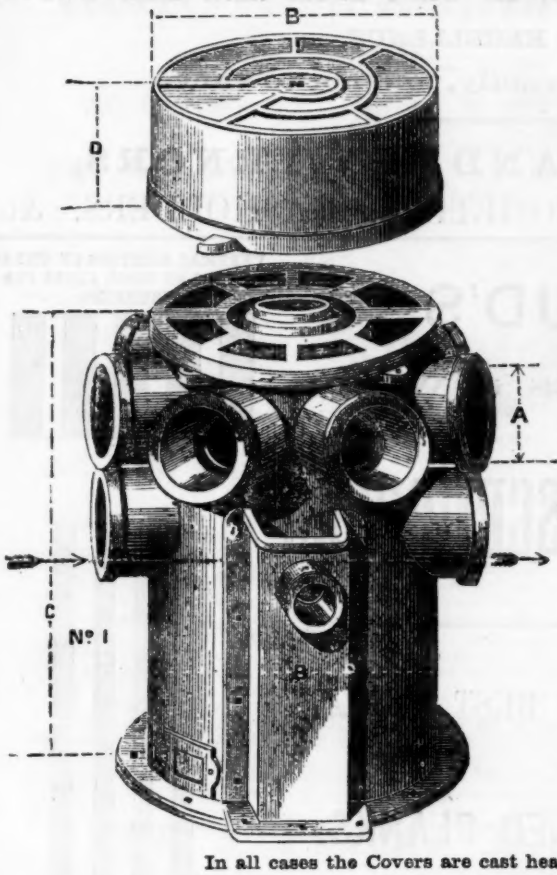
SUPERIOR CAST-STEEL FILES and SAWS; Solid Cast-Steel Hand and Sledge Hammers.
BEST CAST STEEL for making Chisels, Turning Tools, Taps and Dies, Drills, Snaps, &c.
SINGLE AND DOUBLE SHEAR, Spring, Sheet, and Blister Steel.
SILVER STEEL for Rod-Chisels and Diamond-Points for Cutting Cast-Iron Pipes, and for other work requiring a Special Quality and Temper, and every other description of Steel and Tools as supplied to the largest London Gas Companies, Contractors, and Engineers.

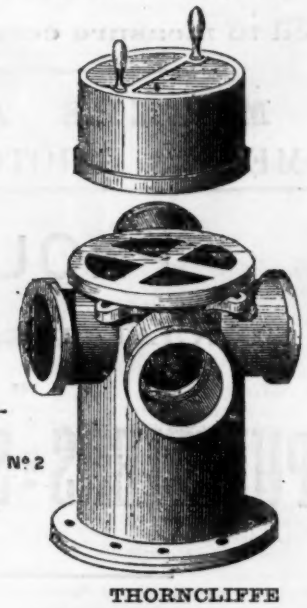
SOHO STEEL-WORKS, SHEFFIELD, & 2, GRESHAM BUILDINGS, BASINGHALL ST., LONDON, E.C.

MESSRS. NEWTON, CHAMBERS, & CO.,

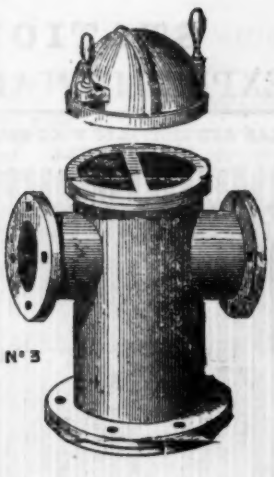
THORNCLIFFE IRON-WORKS, NEAR SHEFFIELD.

IMPROVED CENTRE-VALVES.





THORNCLIFFE
IMPROVED BYE-PASS VALVE.
SIZES FROM 3 INS. UPWARDS.



THORNCLIFFE
IMPROVED STOP-VALVE.
SIZES FROM 3 INS. UPWARDS.

Sizes of the THORNCLIFFE IMPROVED CENTRE-VALVE.

	Ins.	Ins.	Ins.	Ins.	Ins.	Ins.	Ins.	Ins.
A. Bore of Pipe. . .	4 ..	5 ..	6 ..	7 ..	8 ..	9 ..	10 ..	12
B. Diameter of Body.	16 ..	20 ..	23 ..	26 ..	28 ..	31 ..	34 ..	40
C. Height of Tank .	33 ..	35 ..	38 ..	43 ..	46 ..	48 ..	51 ..	56
D. Depth of Cover .	8 ..	9 ..	10 ..	11 ..	12 ..	13 ..	14 ..	16
Total Height . .	44 ..	44 ..	48 ..	54 ..	58 ..	61 ..	65 ..	72

In all cases the Covers are cast heavy enough to resist any required pressure.

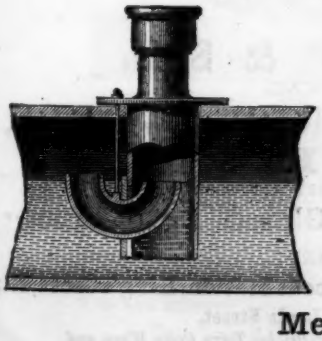
The advantages derived from the adoption of these Valves are so manifest and cardinal that in the immediate character of the change—the simplicity of the machine—the facility affording for cleaning out connexions between Valve and Purifier—the perfect collection and delivery by suitable overflow of the ammonia, at a greatly diminished depth from ground-line over the old form of Valve—the advantage of connecting on the same level, and at any angle, or opposite to each other, the inlet and outlet pipes without dip or rise—the clear acquisition of space in the purifying-house, by being able to place the boxes nearer together, the new Valve being entirely under the floor—and lastly, though of the greatest importance, the passage of crude and unpurified gas during the change is minimized to the merest fraction, thus preventing the fouling by impure gas the delicate machinery and easily affected exposed movements of the station-meter, thereby preventing the introduction of the enemy (unpurified gas) into the gasholder. Also a dead abutment is offered to all back pressure, imparting thereby to the gauges, governors, and hydraulic seals, a steadiness of action never realized with the once famous, but now fast becoming obsolete, Hydraulic Centre-Valve.

N., C., and Co. also Manufacture and Erect

PURIFIERS, CONDENSERS, SCRUBBERS, GASHOLDERS, ROOFS,

And every description of Gas Machinery.

TENDERS GIVEN FOR WORK FIXED COMPLETE IN ANY PART OF THE KINGDOM.



Messrs. N. C. & Co. are also the Sole Agents for

HAWKINS' PATENT SELF-ACTING DIP-PIPES.

These Patent Self-Acting Dip-Pipes are rapidly coming into general use by gas companies. By their use the whole of the pressure caused by the old kind of Dip-Pipes is entirely removed, therefore the yield of gas per ton of coal is considerably increased. They also act as a perfect safeguard against the deposit of carbon (or scurf) inside the retorts.

A saving of fuel is effected, and the wear and tear to the retorts greatly diminished.

They are also perfectly Self-Acting, they being regulated solely by the gas. They cannot get out of repair, and when once fixed, will last as long as the old kind, and can be easily adjusted should the hydraulic main sink; they can also be worked with advantage where there is no exhauster.

Testimonials can be had from Herbert Unwin, Esq., engineer of the Sheffield United Gaslight Company and the Penistone Gas Company. At both these companies works they have been in constant operation for several months. Further testimonials can be had on application to the Patentee, J. G. Hawkins, Effingham Street Gas-Works, Sheffield.

For Prices, &c., apply to

Messrs. NEWTON, CHAMBERS, & CO.,

THORNCLIFFE IRON-WORKS, near SHEFFIELD.

ALDER AND MACKAY,

GRANGE WORKS, EDINBURGH,

MANUFACTURERS OF

CONSUMERS IMPROVED GAS-METERS;

IMPROVED DRY GAS-METERS, in Cast Iron and Tin Cases,

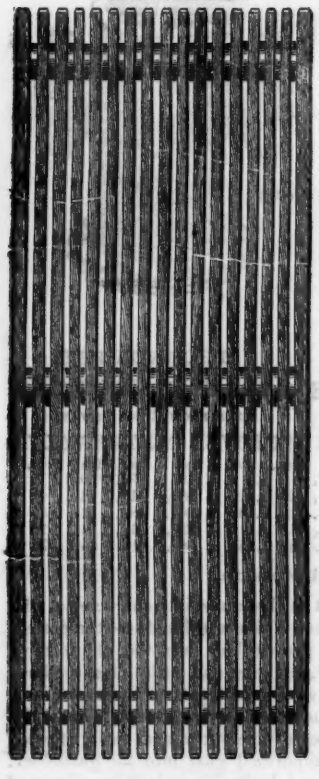
OF THE HIGHEST EXCELLENCE,

Warranted to measure correctly, and not to vary.

STATION METERS AND GOVERNORS,

EXPERIMENTAL METERS, PHOTOMETERS, GASHOLDERS, &c.

PLAN AND SECTION OF WOOD GRID, FOR PURIFIERS.



VERTICAL SECTIONS OF THREE KINDS OF WOOD GRIDS FOR SCRUBBERS.

PROUD'S

SPECIALITIES in WOOD

FOR

PURIFIERS AND SCRUBBERS

MADE FROM THE BEST QUALITY

OF

WELL-SEASONED PLANKS.

BROOKFIELD WORKS,

103, ICKNIELD STREET EAST

BIRMINGHAM.

MADE EITHER TAPER or PARALLEL
WITH SQUARE OR ROUND DISTANCE BLOCKS.

SCALE, ONE-FOURTH FULL SIZE.

Established

1795.

JOSEPH CLIFF & SON,

THE ORIGINAL

WORTLEY FIRE-BRICK WORKS,

NEAR LEEDS,

MANUFACTURERS OF ALL DESCRIPTIONS OF

FIRE GOODS, and Salt-Glazed Drain-Pipes.

LONDON WHARF:

Wharf No. 4, inside Great Northern Goods Station, King's Cross, N.;

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Where is always kept a Stock of Retorts, Fire-Bricks, Terra Cotta Ware, and Drain-Pipes.

TANGYE BROTHERS AND HOLMAN,

LAURENCE POUNTNEY LANE, LONDON, E.C.,

SOLE MAKERS OF

MORTON'S PATENT SELF-SEALING RETORT-LIDS,

WITH

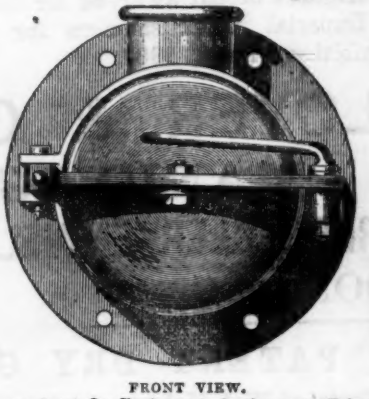
HOLMAN'S PATENT ECCENTRIC FASTENINGS & ANTI-FRICTION CATCHES.

OVER 10,000 IN USE.

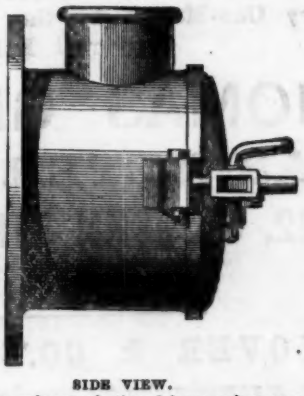
NO LUTING.

LIDS HINGED TO MOUTHPIECES; NO LIFTING ON OR OFF.

NO SCREWS FOR FASTENING.



FRONT VIEW.



SIDE VIEW.

SIMPLE.

ECONOMICAL.

DURABLE.

EFFECTIVE.

NO DUPLICATE LIDS REQUIRED.

These Lids are proved by many eminent Gas Engineers to be the most efficient, saving much time, labour, and expense; are opened and closed as quickly and with as little trouble as an ordinary furnace door, and by their use the Retorts are soundly sealed during the whole period of carbonization.

These Lids are Adopted by the following (among many other) Gas Companies:—

The Gaslight Company, Beckton (where over 2000 are in use).	The West Ham Gas Company.	The Salford Corporation Gas-Works.	The Carmarthen Gas-Works.
„ Gaslight Company, Bow Common.	„ Imperial Gaslight Company.	„ Rochdale Corporation Gas-Works.	„ Merthyr Tydf. Gas-Works.
„ London Gaslight Company.	„ Gas-Works, Arsenal, Woolwich.	„ Liverpool United Gas-Works.	„ Ystrad Gas-Works.
„ Independent Gaslight Company.	„ Commercial Gas Company.	„ Birkenhead Gas-Works.	„ St. Alban's Gas-Works.
„ Phœnix Gaslight Company.	„ Alliance and Dublin Gas-Works.	„ Birmingham Gas-Works.	„ Over Darwen Gas-Works.
„ South Metropolitan Gaslight Co.	„ Edinburgh Gas-Works.	„ Nottingham Gas-Works.	„ Aylesbury Gas-Works.
	„ Manchester Corporatn. Gas-Works.	„ Newcastle-on-Tyne Gas-Works.	„ Cardiff Gas-Works.

The Morton's Lid is made circular in form, that being the most convenient and suitable shape. It can be used for Retorts of any section, by adapting the Mouthpiece casting from the D, oval, or other shape, at the back, to circular in front.

The following important Testimonial, among others, has been given:—

"*The Gaslight and Coke Company (commonly called the Chartered Gas Company), Beckton, North Woolwich, July* 2, 1874.

"Messrs. Tangye Brothers and Holman,

"Gentlemen,—In answer to your inquiry respecting the Self-Sealing Lids, I beg to say that they continue to work well, and I have every reason to be satisfied with them. I should be very sorry to return to the old system of luting, and our stokers here freely acknowledge the benefit to them of the new system.

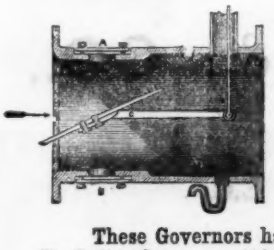
"I am, yours truly,

(Signed) "G. C. TREWBY.

"P.S.—We shall have very shortly about 3000 of your Lids in use."

SOLE MAKERS OF

HUNT'S PATENT EQUILIBRIUM GAS GOVERNOR.



In this Governor a Throttle-Valve is substituted for the ordinary suspended Cone, all external communications being avoided by placing the Lever or Radius Arm (shown at C on the drawing) inside the Valve-Chamber upon the Disc. The Disc is carried upon steel centres, upon which it is accurately balanced and turns freely. The friction in working is thereby reduced to a minimum. This Governor is extremely sensitive to alterations of inlet or outlet pressure, and renders a large actuating holder unnecessary.

The principal advantages of this arrangement over the ordinary form of Governor are as follows:—

Its sensitive action prevents oscillation.

It is self-adjusting—i.e., it maintains a steady pressure under variations of inlet pressure or a fluctuating consumption.

The inlet to Gasholder being contracted to the smallest possible dimensions, all danger from leakage through insufficiency of seal, tilting, &c., is entirely avoided.

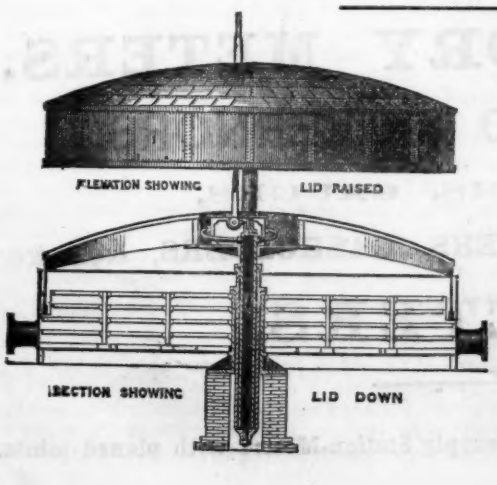
The valve portion being separate from the holder, it can be handled and fixed like an ordinary Slide Valve direct in the main; and the holder can be placed at any convenient distance immediately above it. The cost is thus materially reduced, and the inconvenience of heavy lifts done away with.

There are no working parts likely to get out of order.

These Governors have been adopted by several leading Gas Companies, among whom are the following:—

The Gaslight Company—a 24 in. at Whitechapel District Station.	The Gaslight Company—a 6 in. at the Gas-Works, Beckton.
„ „ a 36 in. at Goswell Road Station.	The London Gas Company—an 18 in. at the Gas-Works, Nine Elms.
„ „ a 24 in. at „ „	„ „ an 8 in. at „ „
„ „ a 24 in. at the Gas-Works, Beckton.	„ „ a 24 in. at „ „

Also at the Gas-Works, Rochdale, Monmouth, Devonport, Cannes, and Mentone (France), &c.



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DIRECT HYDRAULIC LIFT

FOR PURIFIER LIDS

REQUIRES NO TRAVELLERS, CRANES, CHAINS, OR OTHER GEAR.

SAFE, SIMPLE, AND DURABLE.

ANY SIZE LID MAY BE RAISED BY ONE MAN.

Eight Hydraulic Lifts have been applied at Beckton Gas-Works to raise the Covers of the large Check Purifiers, which are 40 feet diameter, during the past three years, with perfect success.

London 1851. New York, 1853. Paris, 1855. London, 1862.

Dublin, 1865.

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PATENT DRY GAS-METERS,

The latter being the Highest Medal awarded for Dry Gas-Meters by the Imperial Commissioners for the Universal Exhibition, Paris, 1867.

Paris, 1867.

THOMAS GLOVER & CO.,

DRY GAS-METER MANUFACTURERS,

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1st, Are a remedy for all the defects of Wet Meters;
2nd, Are suitable for all climates, whether hot or cold;
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4th, Cannot become fixed by frost, however severe;
5th, Are the most accurate and unvarying measurers of Gas;
6th, Prevent jumping or unexpected extinction of the Lights;
7th, May be fixed either above or below the level of the Lights;
8th, Cannot be tampered with, without visibly damaging the outer case;
9th, Will last much longer than Wet Meters;
10th, Will not cost more than one-half for repair that Wet or Water Meters do;
Are upheld for five years without charge.

WILLIAM PARKINSON & CO.,

(SUCCESSORS TO SAMUEL CROSLEY,)

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PATENT WET & DRY METERS,

STATION-METERS AND GOVERNORS,

PRESSURE REGISTERS, GAUGES,

EXPERIMENTAL METERS, PHOTOMETERS, GASHOLDERS, &c., &c.

WATER METERS.

W. P. & Co. beg to state that they are now prepared to supply Station-Meters with planed joints.

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TO CORRESPONDENTS.

No notice can be taken of anonymous communications. Whatever is intended for insertion, must be authenticated by the name and address of the writer; not necessarily for publication, but as a guarantee of good faith.

THE JOURNAL OF GAS LIGHTING,
WATER SUPPLY, & SANITARY IMPROVEMENT.

TUESDAY, JULY 28, 1874.

Circular to Gas Companies.

A HALF-HEARTED prosecution of the Phœnix Company by the Lewisham District Board of Works, for excess of sulphur, has had for the time a satisfactory ending. The proceedings were, of course, taken under the Metropolis Gas Act, 1860, which fixed provisionally the maximum amount of sulphur to be allowed at 20 grains in the 100 feet of gas. The adoption of this limit was called by the late referees a leap in the dark; but it was no such thing. It was chosen because companies were at the time supplying gas with a less proportion of sulphur. But considering that metropolitan gas-works are differently situated as regards facilities for purification, it was foreseen that some might find it difficult or even impossible to keep within the limit mentioned, and therefore it was provided that local authorities and companies might agree between themselves upon some other limit. Some arrangement under this clause promises to be come to by the Lewisham Board and the Phœnix Gas Company. The situation of the manufacturing establishments of the company precludes the possibility of their being able to avail themselves to the full of the use of lime, and they stand much in the position of the Imperial and South Metropolitan companies, to whom the referees now allow 25 grains of sulphur, and will probably allow 30 grains in the winter half year. Their position is really, however, not so good for, having had no notice of any intention to enforce what may be almost considered an obsolete Act of Parliament, the company have had no time to make such extensions and alterations in purifying plant as would be inevitable if the terms of the Act were to be strictly complied with. The other two companies named have had some three years notice, and are only now getting their works into a condition to comply with the requirements of the referees. If the company and the Board agree to a limit of 30 grains, both parties might be satisfied. We cannot, however, refrain from noticing that there was in this instance no complaint from any private consumer, and it would appear to be simply a case of persecution on the part of the Local Board, which the Phœnix Company certainly do not deserve. They deal most liberally with their customers in the all-important matter of illuminating power, and although we have a hearty detestation of retaliatory measures, we should, if prosecutions of this kind be repeated, strongly advise them to give with 20 grains of sulphur just 12-candle gas. If the Local Board insist on a strict compliance with the law in the one respect, they cannot object to literal obedience in the other.

This, which is practically the first prosecution under the Act of 1860, would deserve more notice, but for the fact that, as stated above, we regard the enactment as obsolete. If further metropolitan gas legislation were not to be expected—and we suppose it is inevitable—it might be worth while to inquire how it has happened that the testing clauses of the Act of 1860, which were regarded with so much favour, have never been applied. They gave local authorities and private consumers large powers for persecuting gas companies, and yet they have never been exercised. Our conclusion is that the public are very well satisfied with their gas supply. They would, of course, like to have it cheaper, and we hope that the price will be reduced. But, as regards quality and regularity of supply, we believe that the consumers are well contented, as indeed they may well be. The supineness of the Metropolitan Board of Works and the various District Boards has, doubtless, contributed to the failure. Very few of these latter provided apparatus and appointed examiners, and, when they did, the apparatus was in general incomplete and the examiner incompetent. Had they set about enforcing the Act as soon as it passed, no one could have complained. Its provisions must have been complied with, or modified by subsequent legislation. But to allow, as the Lewisham Board have done, thirteen years to elapse without appointing an examiner, and to come forward as prosecutors now, when gas companies are in acknowledged straits, is an example of meanness which we are happy to think will not be followed by any other local board in the metropolitan district.

It is something in these days to come across a modest undertaking where gas matters are concerned, and we can have no hesitation in saying that the Autogen Pure Gas Company is a modest undertaking. The capital they propose to raise is only £24,000, and of this not more than £1000 is to be paid for preliminary expenses; for the rest, the patentee or patentees are to depend on the success of the company for their remuneration. The so-called gas which the company manufacture is really petroleum vaporized by heat, with an admixture of about 30 per cent. of atmospheric air. The arrangements by which this mixture is produced are extremely ingenious, and are perfectly automatic in their action. An apparatus which will supply 100 lights will supply two or three with equal facility and safety. A description of the apparatus would occupy too much space here; but, after a careful examination of it, we may say that it is admirably adapted to fulfil its requirements. The company very sensibly disclaim any intention of competing with coal gas. They make no promise of extraordinary cheapness, and pretend to nothing impossible to carry out. The invention is well adapted to furnish internal illumination where coal gas is inaccessible. Having had some experience with an apparatus very similar in character, we are inclined to think it would fail in cold weather, with external illumination, even on the limited scale of a small railway station. There is, however, a wide field for the company in the supply of houses, mansions, hotels, and places of worship, where no gas-works exist. They will find, probably, in warmer climates a better field than in more northern latitudes; but in any case we think the ingenuity and perfection of the apparatus will commend themselves to all who wish for artificial light without trouble where gas is not procurable.

Notwithstanding the circumstance that most of the metropolitan gas companies made additions to their prices in the course of last year, we find the consumption by meter still increasing. The whole quantity returned in the accounts as sold by meter in 1873 is a little over 11,018 millions of cubic feet. The increase is most marked in the case of the Chartered Company, whose sales by meter alone were nearly 200 millions in excess of the entire sale last year. On estimating the gas consumed on public lights and by contract, we arrive at the gratifying fact that the gas

sold per ton of coal carbonized by this company is considerably more than in the previous year. It must, in fact, have exceeded 8000 feet, which is a great improvement. If our estimates are correct, the Phœnix and South Metropolitan Company have also increased their sale per ton of coal. The Ratcliff Company, of course, keep at the top of the list under this head, their sale, according to our calculation, amounting to 9400 feet per ton.

The quantity of coal carbonized by the metropolitan companies in 1873 was 1,430,868 tons, which is 78,215 tons more than in the preceding year. An average sale of 9000 feet on this quantity gives just the total increase in the sale of gas for the year—viz., in round numbers, 700 millions of cubic feet.

As regards the highest profit on gas-rental, the relative positions of the companies have, as might be expected, somewhat changed. The London Company heads the list with a gross profit of 35·55, showing that their increase of price has just enabled them to maintain the profit of the previous year. The position of the Chartered Company has improved, but not to the extent we anticipated from the revision of prices. Little remark need be made on other companies; there is a general diminution of profit, as was to be expected.

We append, as usual, a table of the residuals produced per ton of coal. It is interesting, as showing, when compared with the products of previous years, the evenness of working indicative of the skill and care devoted to the management of the works of the several companies. There is a noticeable increase in the quantity of liquor produced which must, we imagine, be ascribed to improved scrubbing arrangements.

Table of the Residuals per Ton of Coals Carbonized and Used, produced by the Metropolitan Gas Companies in the Year 1873.

Name of Company.	Coke per Ton of Coals, in Bushels.	Breeze per Ton of Coals, in Bushels.	Tar per Ton of Coals, in Gallons.	Ammoniacal Liquor per Ton of Coals, in Gallons.
Chartered. . . .	32·59	2·99	9·71	26·17
Commercial . . .	33·04	3·99	10·19	12·47
Imperial	36·00	4·84	8·76	20·17
Independent . . .	35·80	2·41	9·91	13·97
London	33·16	4·28	9·98	19·73
Phœnix.	36·00	2·06	9·49	21·09
Ratcliff	35·88	2·88	7·56	28·98
South Metropolitan	35·45	2·77	9·77	22·43
Surrey Consumers .	33·99	1·98	9·22	9·95
Average. . . .	34·55	3·13	9·39	19·44

Altogether the accounts reveal an extremely satisfactory state of affairs. Sir Charles Dilke, who was so anxious for their early production, it would seem, can found upon them no charge against the companies, while in the City we may be sure they have been received with satisfaction, for metropolitan gas shares, we believe, never stood higher in the market than they do to-day.

It is reported that a requisition, signed by "thousands" of mercantile firms, is about to be presented to the Lord Mayor, asking him to convene a meeting for a full discussion of metropolitan gas affairs. We very much doubt whether the Lord Mayor will lend himself to the designs of the agitators.

An arrangement is nearly completed for the sale by the Eccleshill Gaslight Company to the Corporation of Bradford of all the mains and plant used in the supply of the township of Bolton for a sum of £3500. The contract is not yet signed, but there would appear to be no doubt that the purchase will be completed.

Water and Sanitary Notes.

The Wakefield Water Bill is at last disposed of. After, we believe, 22 days inquiry, the committee of the House of Lords have given the company power to raise new capital to the amount of £125,000, but have refused their sanction to the Little Don scheme. The result is much what we anticipated; but we had fears that the whole of the Bill would be rejected. Two courses seem now open to the company, either one of which must bring them to Parliament next year. They may go higher up the Calder for a supply, or they may sink wells in the red sandstone, at a distance, it would appear, of 20 miles from Wakefield. The latter, according to Mr. Hawksley, would be an experiment which might or might not prove successful, but which, in any case, he estimates will cost the company £10,000, that is merely for the experimental borings. Of the £125,000 which the company may possibly get power to raise, £70,000 are already disposed of in fact or by anticipation. Mr. Hawksley estimates that £30,000 will be required for the costs of this contest; £5500 have to be paid to the Wakefield New Water Company for the scheme which the Lords have rejected, which must be regarded as money purely wasted; £10,000 will be wanted for experimental borings in the sandstone; £10,000 for improvements in the filtering-beds, evidently urgently required, with or without the use of Mr. Spencer's carbide of iron; and £10,000 for another application to Parliament next year. Here is, at all events, an estimate of £40,000 to be spent unproductively for a population (we quote Wakefield only) of, according to the census of 1871, only 28,069 people. We are not informed of the population within the company's limits, but the sum of money spent or to be spent is so monstrous that it must attract attention.

The dearth of water is beginning to be seriously felt in the south of England. In parts of Kent the farmers have to cart it considerable distances for the supply of their cattle, and the Chatham Water-Works Company have been compelled for the present to discontinue their constant supply. In the north the difficulty of keeping up a supply at Bolton increases, and unless there be a heavy fall of rain it will soon be necessary to discontinue a supply for trade purposes, which, if done, will, it is said, throw from 15,000 to 20,000 people out of employment. At Accrington the watering of the streets has been stopped, and every effort is being made to economize the use of water. The farmers in that neighbourhood find great difficulty in getting a supply for their cattle. In Bradford, too, the watering of the streets has been discontinued, and it is intended to shut off the night supply. The Edinburgh reservoirs are said to have fallen, but not yet to such an extent as to create uneasiness. The rainfall in the Glencorse Valley has been much below the average.

It is not only in England that alarm is felt at a scarcity of water. M. Belgrand, the eminent hydrologist in Paris, has published a warning that the streams and springs of the basin of the Seine will continue to decrease from now to October, when their discharge will be very low. His prophecy is based on the fact that the rainfall in the cold season, from Nov. 1, 1873, to April 30, 1874, has been exceptionally small. Rain in the summer months, he says, scarcely increases the volume of streams, since the water is mostly carried into the air by evaporation. "Hence," says M. Belgrand, "it will be understood that, from the rainfall of "the cold months, one can foresee within certain limits what "will be the state of the streams during the ensuing summer. "If the cold season has been a wet one, we may rest assured "that the springs and watercourses will yield well up to the "ensuing autumn. If, on the contrary, the cold season has "been dry, the springs and watercourses will be throughout the "hot season at a very low point." The observation is very important, and Mr. Symons, the eminent meteorologist, has, upon a comparison of the rainfalls, attempted a forecast of the state of the water supply for this autumn in the British islands. "There "is," he says, "reason to believe that in the eastern part of "England the supply of water in wells, ponds, and streams will "be very deficient." His prophecy is evidently in course of fulfilment. The state of the Thames may be watched over with some anxiety, and the supply from our chalk walls here in the south-east may be expected to diminish.

The powers of the Local Government Board are just now being exerted in a way that would have astonished our forefathers. The medical officer of health last September reported that a main drain was necessary for the well-being of St. Columb. His report was forwarded to the Gwydyr House, and in November the Local Government Board wrote to inquire what had been done to improve the condition of the place. The reply was that nothing had been done, and nothing would be done, except under the directions of the central authority. The answer to this was a peremptory order to the local authority to have their district sufficiently sewered without delay. Thereupon the local authority had plans and an estimate prepared, and submitted them to a public meeting of ratepayers and owners. The meeting unanimously rejected the scheme as unnecessary. This fact was communicated to the Local Government Board, who were informed that the Local Board did not propose to take any steps for the better drainage of the district until it had been determined that the existing drains were insufficient, and further instructions in the matter were requested. On the 2nd inst. a letter was received from the Local Government Board, informing the Local Board that it was their duty to provide their district with sufficient sewers, and that they were not relieved from their responsibility by the opinion expressed at the meeting of the ratepayers. The local authority have since decided to wait and act only under the directions of the Central Board. We may, therefore, hear that a *mandamus* has been applied for as soon as Mr. Sclater-Booth's or rather Mr. Stansfeld's Sanitary Amendment Bill becomes law.

Association of Municipal and Sanitary Engineers.—The next meeting of the Lancashire and Cheshire branch of this association will be held at the Municipal Offices, Barrow-in-Furness, on Friday, Aug. 7, at 1.30 p.m. Immediately after the ordinary business, Mr. Jacob will read a short history of the rise and progress of Barrow-in-Furness. The Barrow Docks, the shipbuilding yards, the Hematite Steel-Works, and other objects of interest, will then be visited.

Communicated Article.

MM. MULLER AND EICHELBRENNER'S GAS-FURNACES.

(FROM OUR PARIS CORRESPONDENT.)

In a recent communication on "Siemens and Analogous Heating Systems, as employed at the Gas-Works at Paris" (see our last volume, p. 652), we have stated that it is most desirable to be able to employ heating by combustible gases, and the regeneration of heat lost, in existing furnaces, and thus to generalize the advantages which have been obtained by MM. Siemens, even in small gas-works. MM. Müller and Eichelbrenner have realized this idea, and have applied these principles in a simple and economical manner, much beyond that which has been hitherto attained. In their furnace nothing is changed in regard to the ordinary arrangement of the retorts, but the furnace is replaced by an inclined grate of reduced dimensions, placed at the back of the masonry, and surmounted by a hopper of a conical form. This can be filled with coke at its upper part, and is ordinarily shut; its capacity is sufficiently large to allow of its being charged at only long intervals—say, for example, from 8 to 10 hours. The construction of this hopper, and this mode of charging it at long intervals, constitute a great advantage, especially for small or medium-sized works, where it is desirable that no attention should be required during the night. To this advantage are added all those which arise from heating by gas. The furnace, in fact, is a veritable producer of gas, analogous in its effects to the gas-producing retorts, the combustible matter undergoing on the grate a kind of distillation, or incomplete combustion, owing to the regulation of the quantity of air introduced. As they leave the furnace, the carbonic oxide and other combustible gases enter into a central channel at the bottom of the masonry, whence they pass into the oven by a series of orifices, distributed throughout the length of the floor. At the side of these, corresponding orifices bring in the air, previously heated by its passage through pipes connected with the flues.

This introduction of the air is regulated by a register, placed at the exterior of the oven. Some refractory flags, placed above each of the orifices by which the combustible gases arrive, permit also a more complete regulation, if necessary, of the combustion, and also to attain easily an equal division of the temperature to all the parts of the oven.

This heating of the air obtained by a mode of recuperation analogous to that of the Siemens, Ponsard, and other systems, is less complete, but capable of more general application. It allows of obtaining a greater elevation of temperature, with, at the same time, a greater economy of fuel. Added to this, the work of the inclined grate is very easy, and can be effected by any bricklayer; the cost of maintenance of the furnace, and all parts of the oven which depend on it, is greatly reduced; and, lastly, there is not, in the new ovens, that collection of cinders attending the ordinary grate, which accumulate, little by little, on the retorts, accelerating their destruction, and impeding the regularity of distillation.

The method of feeding the gazogène by means of a hopper of large dimensions, permits equally the use of tar as fuel. For this purpose the cover of the hopper, which is composed of cast-iron or fire-brick, is pierced with a hole, which receives an iron pipe curved into a syphon-like form. This syphon is fed by a fine stream of tar, which falls from a reservoir through a stop-cock, regulated according to the amount required. The tar falls upon the fuel, spreads over the whole mass, owing to the heat giving it fluidity, and distils, little by little, as it descends. The vapours mix with the carbonic oxide, produced by the combustion of the fuel from the hopper, and pass thence into the oven, where they burn with the heated air. The combustion of the tar is ensured by the high temperature of the air, and also by its mixture with a certain quantity of hydrogen produced by the vaporization of a thin stream of water, which arrives at the bottom of the gazogène, and there undergoes decomposition.

This description of MM. Müller and Eichelbrenner's apparatus shows that it may be applied at little expense to existing ovens; it is not necessary, in its application, to touch the vault of the oven. In the case of back-to-back ovens, the simplest method of change consists in placing the gazogène in the length of the wall of the chamber of the ovens and outside, connecting it with the ovens by underground channels intended to bring the carbonic oxide. It is thus easy to heat several ovens with one gazogène.

Already a score of gas-works in France have adopted these new ovens. We have inspected those at work at the gas-works at Montreuil-sous-Bois, where, by way of comparison, can be seen an oven not charged, but mounted on the same masonry. We there found the same advantages as exist in the works of the Parisian Gas Company, where they employ Siemens' ovens, with great cleanliness, and a complete regularity of heat in the combustible gases. The economy of fuel is incontestable. In the small works at Montreuil, four, with a naturally irregular work, consumed last winter only about five hectolitres of coke for each ton of coal distilled. Besides, the construction is simple, easy, and of little cost; the increase in expense resulting from the erection of a gazogène and its appendages costs, for an oven of from five to seven retorts, only about 700 francs (£28).

The advantages arising from the adoption of MM. Müller and Eichelbrenner's arrangement may be summed up as follows:—A ready and cheap application of the new system to all existing ovens; great convenience in the heating; reduction of the working staff, and the abolition of night-work in small gas-works; economy of fuel; diminution of the expense of maintenance; and, lastly, an increased production of gas, owing to uniformity of temperature throughout all parts of the ovens.

In England it has long been desired to do away with Sunday work in gas-works, and the use of this new apparatus affords a solution of the question. We know, in fact, that in some works in France they have succeeded in only charging the retorts once a day, and to charge the hopper with coke only once in 24 hours; and they find, on the next day, the oven in perfect order, and the retorts at a temperature fit to receive a fresh charge of coal.

On the occasion of visiting the work at Montreuil-sous-Bois, we assisted at the trials of MM. Müller and Eichelbrenner with a new arrangement of vertical retorts heated by means of a gazogène. This new arrangement of retorts, which is at present being tested at the Parisian Company's works, permits charging and mechanical luting in a manner more simple and economical than has been arrived at by any machinery yet experimented with in regard to horizontal retorts. We shall keep under our notice the working of these trials, which already give very satisfactory results, especially in regard to the coke, which is of a quality much superior to that got from ordinary retorts.

Correspondence.

INACCURATE WHEELS IN CLOCK-DIALS OF METERS.

SIR,—In regard to the case at the Clerkenwell Police Court, reported in your last, I may state that a similar case occurred some years back, but, in that instance, a wheel of a *smaller* meter had been inserted for the 100,000 hand, having only *half* the number of teeth, so that the *first* two dials registered perfectly accurate; but, when the third dial came into play, it registered just twice as much as it ought. The consumer had complained to me of excessive registration. I had the meter brought in, and tested it by running 10 feet, and afterwards 100 feet, of gas through it, and I found both the drum and the first dial registered perfectly right. I then instructed the inspector to watch the consumption on the consumer's premises, and, upon calculation, I found the consumption only to amount to *half* of the registration. This distressed me exceedingly, feeling *au désespoir* as to what was to be done, and also always feeling the responsibility of acting as a public servant, not only on the part of the gas company, but also on the part of the consumers. However, I did not hesitate long. I had the meter opened and the registering index taken out, and the faulty wheel was at once discovered. Of course, I immediately reduced by one-half the charge to the consumer upon the *entire* registration.

Shortly afterwards I was honoured by a call from Sir Richard Airy, the Astronomer-Royal, who was entrusted by the Government to make the standards of measurement under the Sales of Gas Act. I showed him over our shops for meter repairs, and I explained to him the great pains we took to test our drums and ascertain that they were accurate. He then asked me if I thought there was anything deficient, and I then named to him the registering apparatus, elucidating it by the above circumstance; and I further suggested that the public meter tester should be required to stamp on every wheel and pinion, from the endless screw on the drum to the largest dial, the size of the meter, the position, and the official stamp, so that the whole might be examined from the outside.

Sir Richard entirely coincided, and said that it would be a recommendation of his to the Treasury for an instruction to the justices upon the appointment of the public meter testers for their guidance. Of course, errors may creep in of a *greater* number of teeth. In regard to the Bradford Corporation (mentioned in the JOURNAL of the 14th inst.), who supplied a *two*-dial meter only, I contend that the corporation had no right to surcharge, although the meter might have made two or three entire revolutions without being able to bear any indication thereof. The meter is of their own supplying; they have the opportunity of seeing it twice or oftener every quarter, and I contend that the meter is the sole arbiter between the corporation and the consumer, unless where it can be shown the meter has been fraudulently tampered with by the consumer, or where (by special agreement) it can be shown that it has stopped. It was my rule always to charge by the index of the meter when it was still moving, however imperfectly, and to remedy the defect in future by substituting a more accurately moving meter.

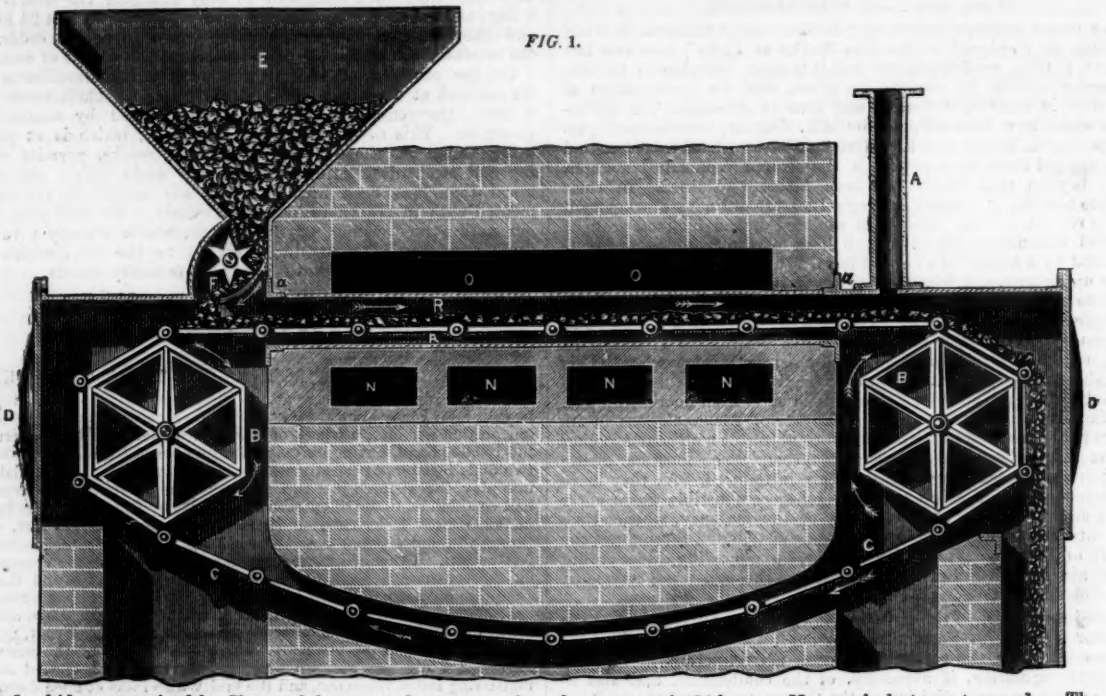
EX-SECRETARY.

A METHOD OF CLEANSING BOTTLES, &c., BY MEANS OF IRON IN PLACE OF LEAD SHOT.—M. Fordos states that in a note presented to the Academy of Sciences, last November, he had demonstrated that lead shot, used to clean bottles, left in them, adhering to their internal surface, carbonate of lead, which was not removed by washing, and which was dissolved in liquids used either for food or physic; consequently dangerous beverages were generated. Small grains of lead were frequently found in bottles of wine, which were not discovered until the bottom of the bottle was arrived at, and from this cause occasional illness arose. The quantity of lead thus accidentally introduced into the wine became much augmented if, while in the use of the lead shot, precautions had not been taken to remove the whole of them. A wine cooper informed him that every day he met with bottles containing more or less of such shot. The particles of lead, by the action of air and moisture, produced the carbonate which, adhering to the sides of the glass, were not taken away during washing. Consequently they dissolved in the wine, producing more or less injurous results. M. Fordos consequently sought for some substitute for the leaden shot. He took pieces of iron wire from 4 to 5 millimètres in length, and of different gauges. Those numbering from 16 to 18 gave a material useful in the case of phials. For bottles, he preferred a gauge of No. 22. The iron shot were not only equal, but superior to the lead as a means of cleansing. For two months the phials used at the Hôpital de la Charité were cleaned with iron far better than with the lead shot, and the experience of a wine cooper showed the superior excellence of the iron material. During the cleansing process the iron is certainly attacked by atmospheric oxygen, but the ferruginous compound does not, like the lead, attach itself to the glass, and hence is consequently speedily removed by washing. A small amount of oxide of iron left has no prejudicial action in respect to health. The question arose, however, how far this oxide of iron might act on the colour of wines. Numerous experiments were made to determine this question, and the result seems to have shown that no effect takes place. But in the case of very light-coloured wines, M. Fordos recommends it as prudent to employ tin shot, as is commonly used in cleaning champagne bottles. He suggests that the iron shot should be kept in a phial, tightly corked and full of water, to which a little carbonate of soda may be added to prevent the action of the oxygen on the metal.

A TREATISE ON THE SCIENCE AND PRACTICE OF THE MANUFACTURE AND DISTRIBUTION OF COAL GAS.

XXIII.

FIG. 1.



The fixed idea entertained by Clegg, of the great advantages to be derived from distilling coal in a thin stratum, which, as explained, he had already submitted to practice, but failed in accomplishing through the defective construction of his apparatus, induced him to make another attempt to achieve success in that direction, by the invention of the web retort, of which the above is a longitudinal section, copied from his son's "Treatise on Coal Gas."

We are unacquainted with the period of the invention, nor does it appear to have been in operation at any gas-works. It is presented as possessing great ingenuity and considerable interest at the present time, when the charging and drawing of retorts by mechanical means, is engaging so much attention.

The name "web," or "woven," was derived from the construction of that part of the machine which conveyed the coal into and the coke out of the retort, when undergoing carbonization, and is represented by the letters, C C. This consisted of a number of flat bars of about $\frac{3}{4}$-inch by $\frac{1}{4}$-inch, placed edgeways, parallel to each other, with bolts connecting together two sets of links, thus forming a continuous flat chain of about 2 feet wide and of sufficient length to pass over the two hexagonal drums, B and B.

The retort, R R, properly speaking, was embraced between the flanges, *a* and *a*, and was made of $\frac{1}{2}$-inch boiler plate, protected on the under side by fire-slabs. The hopper, E, and the rest of the framework was constructed of a similar material. The two doors, D and D, requisite for renewing the web or other repairs, we may assume, were of much stouter material, and bolted to the general frame.

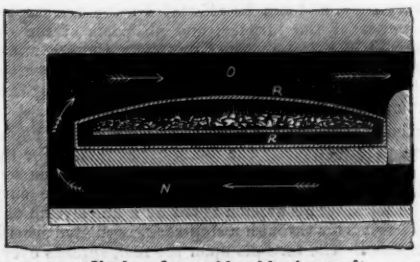
The two revolving hexagonal "drums," B and B, gearing with each other, were driven by water or steam power, and over them passed the endless web, C C, and, on motion being given to the drums, the web was caused to travel continuously in the direction of the arrows, at such speed that the coal placed thereon would pass from one end of the retort to the other, in about 15 minutes.

The coal destined for carbonization was broken into small pieces "not larger than coffee berries," of which the hopper, when full, contained sufficient for 24 hours operation; when it was closed at top by a cover sealed with a water-lute similar to that employed in dry lime purifiers, but which is not shown in the original drawing. At the lower part of the hopper was a star-shaped wheel, F, its length being equal to the breadth of the web. This wheel was in gear with, and received its motion from, the drums, B B, so that the coals were by this means delivered from the hopper on to the web, gradually and continuously, and in passing through the retort the coal was carbonized, the gas issuing by the pipe, A, and the coke falling from the web into a well provided with an air-tight door, or sealed by means of water.

The furnace is supposed to have been in the front, and the heat therefrom passed through the nostrils, N N, under the retort, and then over it, to the main flue, as represented in fig. 2, in section.

According to Clegg, "The main advantages attendant upon this form of retort are that it requires less space. The stokers (so called at present) might be spared that name. The heat would not be felt more than in a boiler-house, and the retort-house might be kept perfectly clean, wholesome, and free from suffocating vapour." He adds, "The system is one of great economy, and by far the most scientific process yet adopted for making coal gas. It requires no attendance, except that of keeping up the furnace, and charging the hopper once in 24 hours. No gas is lost, no tar made. The coke produced is increased in quantity about 25 per cent., but its quality is not so well fitted for general uses, although far superior for culinary purposes." The estimated make was about 12,000 cubic feet of gas, specific gravity 490 (about 19-candle gas), from a ton of Newcastle coal.

FIG. 2.



That the system displayed considerable ingenuity, must be admitted; but, unfortunately, amidst the number of excellent practical inventions produced by Clegg, there were others of an opposite character, and the web retort may be classed amongst them.

One difficulty attending the application of this system was identical with that in the horizontal rotary retort; in both cases the heat from the furnace, instead of being confined and concentrated within reasonable limits, was of necessity dissipated throughout the whole space occupied by the apparatus; so that, to obtain the temperature for the retorts requisite for carbonization, a large amount of fuel must have been expended. Again, the chains forming the web would be speedily so swollen, or distorted by the red heat, as to render their action quite impossible, and the stratum of coal being regulated to a thickness of three-eighths of an inch only, as proposed, would render the resulting coke of little more value than breeze. Lastly, in operation, the coke from caking coal would have a tendency to adhere to the web, and not fall as shown. In short, the web retort was one of those schemes which look well at first sight on paper, but which, when submitted to practice, are found to be useless.

No explanation can be given of the stated high production of gas, both in quantity and quality, beyond the observation, that an infatuated, sanguine mind is often, innocently, led to the most erroneous conclusions, which must have been the case with Clegg, for he was utterly incapable of wilfully making an erroneous or unfair statement.

Between the periods of the publication of "Gas Lights," by Creighton, and Clegg's "Treatise on Coal Gas," so far as we have been able to learn, only two works on the subject were presented to the public—viz., the "Compendium of Gas Lighting," by Matthews, published in 1827; and the "Traité sur le Gaz," by Merle, produced ten years afterwards. The second edition of Peckstone was substantially a copy of the first, and is therefore not taken into consideration.

On consulting the two authors mentioned, we find that no attempts at improvement in retort-setting were made during this time; indeed, in Matthews's "Compendium," the most prominent setting is represented as having seven retorts in a bed, heated by four fires; and in

the plan of the Imperial Continental Company's works, by Merle, the beds, of four retorts each, are heated by two fires—neither of which systems could be regarded as progressive, and we are led to the conclusion that, at the epoch in question, considerable apathy existed on this, as well as on many other points, amongst gas engineers.

The publication of the "Treatise on Coal Gas," by Samuel Clegg, jun., in 1841,* presented a new era in the art of gas lighting. The descriptions of the various apparatus, with the excellent drawings, the vast amount of information given, and the detail entered into, had never been previously attempted, and its production very deservedly excited the warmest admiration and praise by all connected with gas lighting. Most conspicuous amongst the drawings was a setting of five retorts, heated by one fire. By whom this was designed we are not told, but we may safely assume its author to be the elder Clegg, who had gradually improved this branch of manufacture, until he arrived at that point of excellence displayed in this method of setting retorts. For several years this system was adopted by most of the metropolitan gas companies, as well as at many gas-works in the provinces and on the Continent; and at the present day there exists, at one of the London gas-works, arches which were built for the settings in question.

Fig. 3 represents a longitudinal section, and fig. 4 a cross section, of this mode of setting retorts.

FIG. 3.

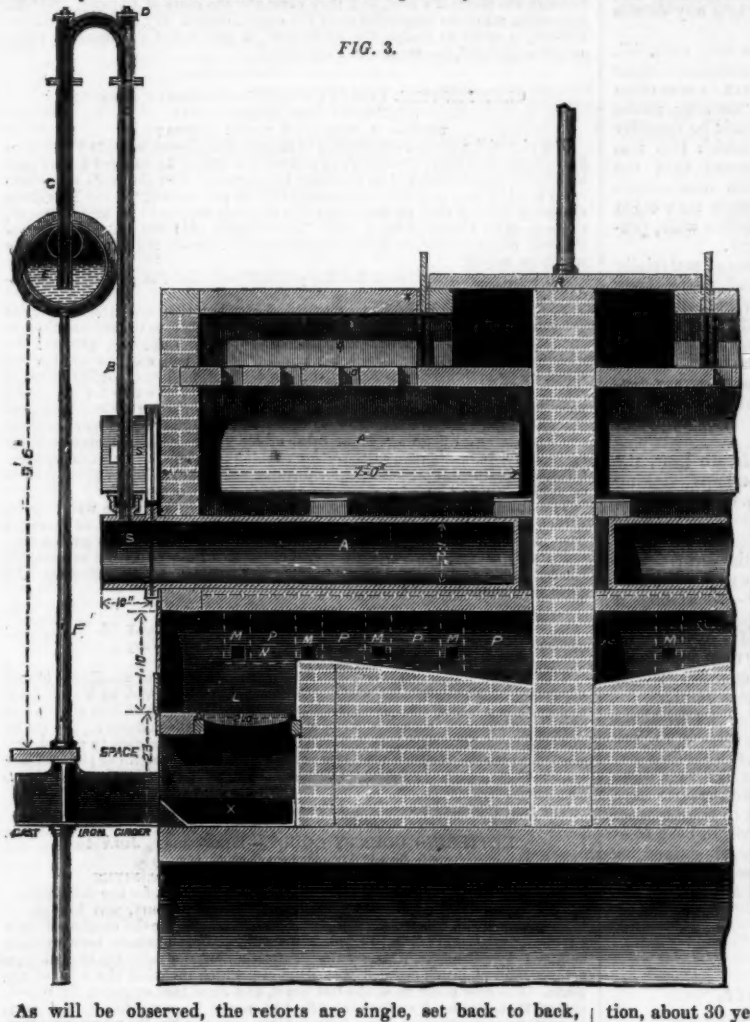
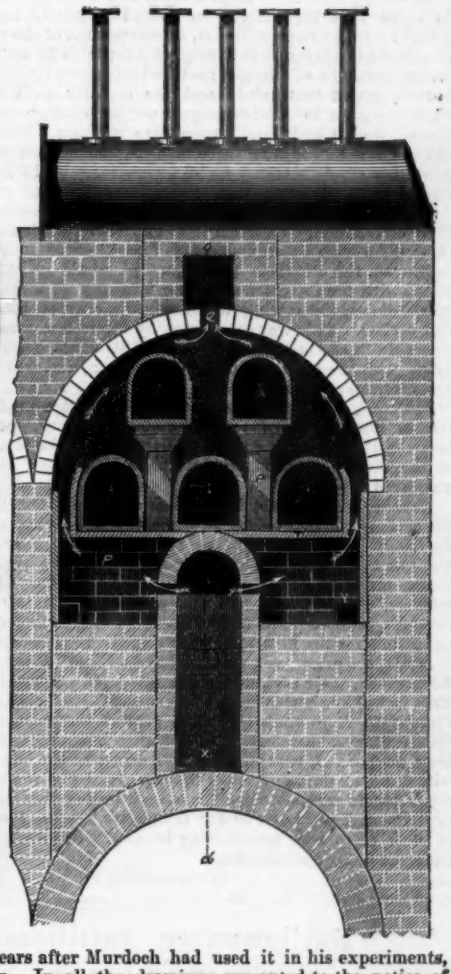


FIG. 4.



As will be observed, the retorts are single, set back to back, with a 14-inch wall between them, there being a space of about 4 inches between the end of the retort and the wall, to allow of the expansion of the former when heated. An iron retort of the length described, on arriving at the temperature necessary for carbonization, would elongate about 2½ inches, and if from peculiar circumstances it were to be so heated, and afterwards "let down," or cooled, two or three different times, it would be permanently increased in length to the extent stated. This peculiar property of metals was one of the causes of the failure of Clegg's inferential dry meter hereafter referred to.

In fig. 4 is shown an arch over the fire-place, which was continued throughout the length of the oven, as seen in section, fig. 3. There were four transverse walls, not including the front wall, one of which, P, is shown in cross section, almost reaching to the top of the arch; they are also shown in dotted lines in the longitudinal section. On these transverse walls were placed fire-slabs of 2½ to 3 inches thick, covering the whole of the area on which the lower retorts were to be placed, the tops of these being on a level with the crown of the arch, leaving a space at the two sides of 2 or 3 inches wide, extending the length of the retorts, for the heat to pass, as indicated by the arrows. This was the "bench" of the setting. The term is now synonymous with "bed," or "setting;" "stack" is sometimes also employed with the same meaning, but this is more generally applied to a block of settings. The outer lower retorts were shielded by curved fire-tiles, otherwise their duration would have been but transitory.

The heat as generated in the furnace, L, passed through the orifices, M M, so up by the sides of the shield tiles on to the lateral flue, Q, where for the first time we find the damper, Z, practically in operation, about 30 years after Murdoch had used it in his experiments, as already shown. In all the drawings presented to the notice of the reader, and in all the drawings in works on gas we have met with up to the period of the publication of Clegg's work, including those by Peckstone of 1841, the air for supplying the furnaces was always admitted by a door on the ash-pan.

Assuming the privilege of pointing out defects, for the guidance of the uninitiated, we may remark that the greatest error in the arrangement consists in the nostrils, M M, being much too contracted. This is highly objectionable, for instead of these being of the limited capacity shown, they should be as large as possible, so that the heat as generated, could pass from the furnace to the interior of oven, with perfect freedom, and afterwards circulate throughout the oven, the strictest care being observed to prevent any undue loss of heat by controlling the dampers. By contracted nostrils—a defect which frequently exists in settings—although the furnace may be at a white heat, it is sometimes impossible for the retorts to attain that temperature which is essential for carbonization.

And here we observe the marked difference between the means of admitting the air to the furnace by a door in the ash-pan, and checking its exit to the chimney by the damper. In the first instance a direct communication is established between the interior of the oven and the chimney, while in the latter method the damper becomes the means of separating the one from the other. Where the draught of a setting is suitable, the passage at that point is very limited.

Hitherto we have spoken only of iron retorts, those of clay will hereafter engage our attention; and, as the experience of many of our readers does not extend to the general application of the former, a few words concerning them may not be considered out of place.

Cast iron for retorts was adopted on account of the special advantages that metal presented over all other materials as regarded price and general practicability, but years of experience demonstrated the numerous inconveniences that retorts so constructed were subjected

* The same year, Peckstone produced the third edition of his "Theory and Practice of Gas Lighting," which, however, presented no material alteration, except that it showed one section of three retorts, and another of five retorts, each heated by one fire.

to, the most prominent of these being their liability to rapid destruction when submitted to that degree of heat most suitable alike for the economical production of gas and coke. This evil was further increased by ignorance of many matters connected therewith, and notably the cause and effects of the carbon encrusted within the retorts. Had these been understood, and the exhauster applied with the same care as at the present time, the change from iron to clay retorts would not have been so desirable. Nevertheless, that change was productive of the most beneficial results in the economy of the manufacture of gas, and whenever iron retorts are now employed (unless in conjunction with those of clay) the works may be pronounced to be badly managed; and, with the impression that few, if any, of such establishments exist, we do not enter into any details as to the means of working them.

In setting iron retorts, great care and intelligence were essential, in order that they might be heated regularly throughout their length. When improperly set, a large portion of the retort was often at so low a temperature as to be quite unsuitable for carbonizing, whilst its end would be of a bright heat, and consequently would be speedily burned out at that point; and the rapidity with which this was effected, even in well-managed works, clearly proved that the necessary care and intelligence were wanting. Often iron retorts did not last longer than three months, and seldom more than eight months, a single retort, 7 feet 6 inches long by 15 inches wide, producing in its lifetime an average of 750,000 feet of gas.

The accumulation of carbon on their interior facilitated materially their destruction, and, when least expected and desired, particularly in small works, a retort would be found burned out; and one being destroyed, the others in the same bed would quickly follow, when often, with the intention of saving for future service some apparently good retorts, the setting was let down, only to find them cracked and useless. This was occasioned by the iron contracting very considerably in cooling, whilst the carbon attached to the retort not being so affected, the retort yielded to the carbon, and was in consequence broken transversely across its centre.

At times, through inferior metal, even at a moderate heat, the retorts would assume various distorted forms, perhaps sinking between the supporting piers, or flattening at the top, or bulging out at the sides and displacing a shield tile, when their days were numbered.

Another difficulty attending their use, arose from the formation of the carburet of iron on the exterior, this also being a great non-conductor of heat, required to be removed periodically—about once a week or so—which was done by passing a rake through the sight-boxes, made sufficiently large for the purpose. However, in all settings, there was sure to be an accumulation of this deposit in some inaccessible place, and when it existed in any quantity, it was impossible for the heat to penetrate to the retort at that point.

Again, the price was a very serious question. When they were about £6 per ton, their cost, including settings, was about 6d. or 7d. per 1000 feet of gas carbonized, whereas the cost of clay retorts does not amount to more than the sixth part of that sum. With all these disadvantages, therefore, it is not surprising that iron retorts have been abandoned, except, as before mentioned, when in combination with those of clay, and when they are heated by the waste heat from the latter, to which we shall have occasion to refer; or when fixed for experimental purposes, or for temporary irregular supplies of gas. In such cases iron retorts may be used with some advantage, but under no other circumstances.

(*To be continued.*)

Parliamentary Intelligence.

HOUSE OF LORDS.

THURSDAY, JULY 23, 1874.

The Wakefield Water Bill was reported from the Select Committee, with amendments.

The Cupar Water and Dundee Water Bills were returned from the Commons with the amendments agreed to.

The Sanitary Laws Amendment Bill was ordered to be read a second time on Thursday, July 30.

HOUSE OF COMMONS.

TUESDAY, JULY 21, 1874.

The Lords amendments to the Cupar Water and Dundee Water Bills were agreed to.

Legal Intelligence.

ROLLS COURT.—FRIDAY, JULY 24.

(*Before the* MASTER OF THE ROLLS.)

OWEN *v.* THE BARMOUTH LOCAL BOARD OF HEALTH.

Mr. CHITTY, Q.C., and Mr. W. W. COOPER appeared for the plaintiff; Mr. SOUTHGATE, Q.C., and Mr. T. STEPHENS for the defendants.

The bill in this suit was filed to restrain the Barmouth Local Board of Health from abstracting water from a brook called the Ceilant Brook, flowing through the plaintiff's land. The whole ordinary flow of this brook was stated not to exceed 77,000 gallons per day, and in summer it is sometimes dry. The defendants having in December, 1873, bought a piece of land on the bank of this brook for the purpose of obtaining the right of water, in April last put a 5-inch iron pipe into the brook, capable of conveying to their reservoir 67,000 gallons of water in the 24 hours, and it was admitted that they had been abstracting about seven-eighths of the water without returning any part of it to the brook. The plaintiff is the owner of an ancient mill, now disused, and two cottages lower down the stream, and he insisted that his rights as a riparian owner were being injuriously affected by the acts of the defendants.

The MASTER OF THE ROLLS said that the defence of acquiescence failed, for it had not been shown that the plaintiff in December knew the particulars of what the defendants were about to do, nor even in April would he have been justified in presuming that they were about to do an unlawful act. As a riparian owner, the plaintiff had a right to have the natural flow of water through his land, and to the use of it for all ordinary purposes. It could not be said that he would not sustain sensible damage by the abstraction of seven-eighths of the water. But his honour need not enter into that question, for the local board had only the ordinary rights of a riparian owner, and according to a recent case (*Wilts and Berks Canal Navigation Company v. Swindon Water-Works Company*) the diversion of the water of a stream for the purpose of sending it in large quantities to a reservoir to supply a town is not within those rights. As the defendants were diverting water for a purpose which was not legal, actual pecuniary damage was not necessary to give a right of action or suit. He could not make it a question of damages, however much he might personally wish to do so, having regard to the inconvenience to which the people of Barmouth might be subjected in consequence of his granting an injunction. The defendants must be restrained from abstracting or diverting water from the brook so as to injuriously affect the supply of water flowing through the plaintiff's land, and they must pay the costs of the suit. But the injunction would be suspended until the second motion day in the Michaelmas sittings, in order to enable the defendants, if they could not come to terms with the plaintiff, to obtain water elsewhere.

CLERKENWELL COUNTY COURT.—THURSDAY, JULY 23.

(*Before Mr.* WHITBREAD, *Judge.*)

THOMAS *v.* THE NEW RIVER COMPANY.

The plaintiff, a gentleman residing in Highbury Crescent, brought this action against the New River Company, to recover the sum of 4s. charged to and paid by him for water employed in watering his garden. The plaintiff's house was rated at £115, and he paid a water-rate of £6 4s. per annum, but the New River Company finding that he used part of the water supplied him on his garden, made an extra charge of 8s. a year. The plaintiff paid the first half year demanded, under protest, he being threatened that if he did not pay it the supply would be cut off.

Mr. CARPENTER appeared for the plaintiff, and Mr. POLAND for the defendants.

The *Plaintiff* was examined as to the facts, but this was merely a formal proceeding, as the facts were not disputed. The whole case turned on the construction of the New River Company's Act, 15 & 16 Vict., cap. 160, and the meaning of the words "domestic purposes." The two sections of this Act relied on by both parties were the 35th and 38th. The former section fixes the rate at which occupiers shall be assessed for the supply of water for "domestic purposes," and the latter explains "that a supply of water for domestic purposes shall not include a supply of water for steam-engines or railway purposes, or for warming or ventilating purposes, or for working any machine or apparatus, or for baths, horses, cattle, or for washing carriages, or for gardens, fountains, or ornamental purposes, or for flushing sewers or drains, or for any trade or manufacture or business requiring an extra supply of water."

The JUDGE held that the tenant was not justified in using the water for his garden without making an extra payment to the company for it, and therefore gave judgment for the defendants. The plaintiff having said his garden consisted only of 140 square yards of grass lawn, with ornamental borders, the learned judge said the size of the garden did not make any difference. No costs were asked for.

LORD MAYOR'S COURT.—WEDNESDAY, JULY 23.

(*Before Sir* T. CHAMBERS *and a Common Jury.*)

SOARES *v.* SKOINES.

This was an action to recover £100 from the defendant for an alleged breach of contract. The defendant was the owner of a patent, which he was desirous of a company taking up. He agreed with the plaintiff to give him £100 worth of original shares if he would write a prospectus for the company. He did so, and the defendant sent him deferred shares, which he refused to accept, and sent them back. He then sent him some other shares, which the plaintiff also sent back, and then the defendant claimed the right of sending him what shares he pleased.

The jury returned a verdict for the plaintiff for £75.

KETTERING COUNTY COURT.—WEDNESDAY, JULY 15.

(*Before* R. HARRINGTON, *Esq., Judge.*)

KETTERING GASLIGHT AND COKE COMPANY *v.* NIVEN.

Mr. HENRY appeared for the plaintiffs, and Mr. WAVELL for the defendant.

This action, which has previously been before the court, was brought to recover possession of certain plans and specifications for the erection of new purifiers, sheds, and chimney at plaintiffs works, alleged to have been wrongly detained by defendant, whereby the completion of the said works had been delayed, and plaintiffs claimed £45 damages, which included the cost of the plans. The case came on at the last court, and upon that occasion Mr. Wavell argued that, inasmuch as the plaintiffs had never been registered as a company, they were disabled from bringing an action. Mr. Whigham, who then acted as judge, held that the argument was conclusive, and nonsuited the plaintiffs. Upon this a new trial was moved for, and the case accordingly now came on again.

Mr. WAVELL raised the same objection as before, and quoted several Acts in support. By the Act 10 & 11 Vict., cap. 78, sec. 7, complete registration was rendered necessary. Section 4 of the Act 19 & 20 Vict., cap. 47, enacted that not more than 20 persons (here there were 70) could enter into partnership for trade or business, having gain for its object, unless registered as a company under the Act. The Act of 1862 was to the same effect. It repealed all the previous Acts, and the 209th section said that "every other company required, by any Act hereby repealed, to register under the Joint-Stock Company's Act, or any one of such Acts, and which had not registered, shall, on or before the 31st day from the commencement of this Act, register as a company." Then the next section enacted that if any company required by such section to register under this Act made default in complying with the provisions thereof, then until such company was registered the following, among other consequences, shall ensue:—The company shall be incapable of suing either at law or in equity, but shall not be incapable of being made a defendant to a suit either at law or in equity.

The JUDGE asked if there had been any decision on the construction of the Act.

Mr. WAVELL cited the case of *Harris v. Avery*, in which it was ruled by Justice Byles and other judges that a number of men, 41 in number, who had joined together to purchase a farm for the purpose of obtaining the franchise, did so to obtain gain or advantage, and that they could not obtain such gain or advantage because they were not a legally constituted company, not having been registered.

The JUDGE thought there was some difference between this case and the one which he had quoted, the latter being an appeal against the decision of a revising barrister.

Mr. WAVELL replied that all the judges were unanimous in deciding that they were illegally an association, and he contended that it was a case in point.

Mr. HENRY reminded his honour that Mr. Wavell had omitted to call attention to the Act of 1857, 20 & 21 Vict., cap. 14, sec. 3, which repealed the 4th section of the Act of 1856. He would call attention to the case of *Wormersley v. Merritt*, reported in the *Law Journal Reports* for 1868, which, he contended, settled the whole case. The case was heard before Vice-Chancellor Malins, and it was one in which the plaintiffs formed a partnership in 1855,

but were never completely registered. In this it was held that the partnership could not sue in its corporate capacity, but that individual members were not disabled from suing on behalf of themselves and others. He also argued that the register of existing companies had never been compulsory, except during the short period the Act of 1856 was enforced.

Mr. WAVELL submitted that there was nothing in Mr. Henry's argument to prove that the Act of 1844 was repealed by the Act of 1857, and it was by the former Act he stood.

The JUDGE asked what the learned counsel had to say with regard to the decision of Vice-Chancellor Malins. It would be no use endeavouring to impeach the authority of a superior court.

Mr. WAVELL contended that this court was not affected by Vice-Chancellor Malins's decision. His honour was sitting not as a court of equity but as a court of law.

The JUDGE said he entertained a different opinion.

Mr. WAVELL said the Vice-Chancellor appeared to have overlooked the 58th section of the Act of 1844. Justice Byles had decided the other way.

The JUDGE remarked that where there were two contradictory decisions, he was bound to follow the latest.

Mr. WAVELL said he thought if he could show that there were statutes requiring something to be done, his honour need not regard these decisions at all.

The JUDGE said he should be subjected to well-deserved censure if he decided to overlook a decision of a superior court, whether that decision might be right or wrong. If it could be shown him that the decisions were not applicable to this particular question, it was another thing altogether. The question was one of great importance, and he intended to look into all the authorities himself before giving his decision. He would now hear the facts of the case.

Mr. WAVELL informed his honour that it was the intention of his client to appeal to the Court of Queen's Bench if the case were decided against him.

The JUDGE replied that, whichever way the court decided, the matter was of sufficient importance to justify such a course.

Mr. HENRY then opened the case for the plaintiffs. He said in the beginning of 1870 they were desirous of altering their works. The defendant was at that time engaged as their working manager, at a salary of £100 per annum. When appointed, he informed the committee that he was able to prepare plans and specifications, and for this, amongst other reasons, it was decided to engage him. In March he prepared for them a plan of a new gasholder, and in September of the same year he prepared the plans of all their works. In 1873 he prepared plans and specifications of new stables, engines, and new purifiers, sheds, and chimney, and this he (Mr. Henry) alleged was part of his ordinary duties. The materials were paid for by the company. He did the work in their time, and he never was allowed or claimed extra remuneration for those services. After the plans had been passed, Messrs. J. and F. Henson, builders, of Kettering, and Mr. R. Dempster, of Elland, were engaged to carry ont the work. In fact, the works were in progress when the defendant's connexion with the company ceased, and on his leaving he took with him the plans and specifications that were now in dispute. After the defendant left, Mr. Maddocks, the secretary to the company, wrote to him, requesting him to return the plans and specifications, in reply to which he said that he thought the company had no right to call upon him for what he had "studied and gained for himself," and that he should act upon his father's advice. Other letters were written to him by Mr. Garrard, plaintiffs solicitor, but no reply was received.

Mr. *Maddocks* and Mr. *Stockburn*, one of the committee present when the defendant was appointed, gave evidence as to the terms under which the engagement was entered into.

In reply to Mr. WAVELL, the last witness said he believed his father wrote to the defendant, informing him of his having been appointed, to which the defendant replied, accepting the appointment.

Mr. *Henson*, builder, gave evidence to the effect that, in consequence of the defendant having carried off the plans, he was unable to proceed with the work until others had been drawn.

Mr. WAVELL submitted that he had no case to answer. The contract was one which required to be in writing, and Mr. Stockburn had said that a letter was written by his father (the chairman of the company) giving the terms of the agreement, to which a reply was sent by the defendant. That had not been produced, and he argued that there was therefore no case.

The JUDGE did not see it. If he requested his butler to draw the plan of a pantry, he should not expect him to carry it off, although there might be an agreement as to his duties, and this was not mentioned as one of them.

Mr. WAVELL: There would be a distinct service proved in your case, but in this there had been no one called to show any contract between the parties. Unless this was proved it could not be said that he had committed a breach of duty.

The JUDGE: Supposing he had not been their servant at all, but had voluntarily drawn the plans, he could not carry them away if he afterwards changed his mind.

Mr. WAVELL then urged that the plaintiffs had shown no right of property at all, but his honour was against him on these points, and Mr. Wavell then proceeded with his case. He first submitted that the defendant was engaged as working gas manager, and his duties did not in any respect embrace the drawing of plans or specifications. He would also produce evidence to show that at the time he was engaged nothing whatever was said on the question of making plans, and that after he had drawn them he had made an application to Mr. Toller for payment. Mr. Toller was the chairman of the committee, and replied that after matters were put straight this would be seen to.

The *Defendant* was then called and deposed to the facts stated by the learned counsel, and added that a few days before he left he sent Mr. Dempster tracings of the plans.

The JUDGE asked the defendant why he did not agree to give up the plans, and leave the question as to whether he was entitled to payment to be settled by the court.

The *Defendant* said he did not know that the plaintiffs had made such an offer.

The JUDGE could not understand that, seeing that they had made the offer on two or three occasions.

Mr. *Craven*, of Gainsborough, said he had been engaged for 19 years in connexion with gas-works, and at the present time was acting for the corporation of that town as engineer for the construction of new gas-works there. It was the custom for contractors when they entered upon the contract to at once take all particulars, so that it was unnecessary for them to see the plans again. He did not believe the works could have been delayed by the carrying off of the plans by the defendant.

Mr. HENRY having addressed the court,

The JUDGE said that as his mind was made up upon the merits of the case, he would deliver judgment, but that judgment must not be entered until he had considered the question raised by the learned counsel for the defence namely, that the plaintiffs, not having been registered under the Companies Acts, were disabled from taking any action in a court of law. He would consult the authorities upon this matter, and send his decision to the registrar of the court. He entertained no doubt whatever that, upon the merits of the case, the plaintiffs were entitled to a verdict. Where a man was in the service of another, and voluntarily did work of this description for his employers without a specific bargain as to remuneration, he did the work as the servant, and it became the property of the masters. He would have agreed with the arguments of the learned counsel if it could have been shown to him that there had been a distinct refusal on the part of the servant to do the work, and that subsequently he had agreed to do it in consideration of payment; but nothing of the kind was forthcoming. The only evidence offered was that the defendant had, in course of conversation with Mr Toller, made a remark to the effect that he expected to be paid, and that the gentleman had replied that when things were straight it would be seen to. That conversation did not take place at the committee meeting held immediately afterwards, nor at any subsequent meeting; and as he had made no application for payment to those who were the parties to have considered it, he must decide that the work was done by him as servant of the company. Then again, when written to and asked to return the plans, he made no claim whatever for payment, but simply refused to give them up, and he must therefore decide that the plans were the property of the plaintiffs. The question of damages was the most difficult one to decide, and he would have liked in this matter to have had the assistance of a jury to determine what sum the plaintiffs were reasonably entitled to. In estimating those damages, he could not drive from his mind the behaviour of the defendant throughout the whole transaction. Either the plans belonged to himself or to the company. Why, then, did he make such a great matter of it, and instruct a learned counsel to attend and make every possible objection, and expend such an amount of talent and ingenuity in endeavouring to defeat the plaintiffs claim? If it were of such small importance as it was now alleged, why, he asked, did he disregard what had passed in the open court, and refuse to deliver up the plans when informed that the work of alteration was stopped upon that account? The court would afterwards have decided as to whether he was entitled to remuneration for those plans. He could not but come to the conclusion that this refusal was because the defendant wished to have the satisfaction of hampering and retarding the company in their work, and, looking over the whole of the case, there was an evidence that he was actuated by a distinct motive of malice towards them. That was a circumstance which certainly ought not to be excluded from being put before a jury, or from his mind, in judging what reasonable amount of damages should be assessed in this case. Further, the efforts now made by the defendant to show that the plans were of little or no use to the company were inconsistent with the rest of his case and conduct, and Mr. Craven's statement that the plans were not required by the contractor was so absurd that he could not attach any great importance to the remainder of his evidence. He was of opinion, therefore, that the plaintiffs had sustained real and substantial damages, and he did not consider that the amount claimed (£40) was an exorbitant sum. As the plans had been abandoned, and fresh ones obtained, he did not suppose much value would now be attached by the company to the defendant's, and he would therefore estimate those at £1, making the damages awarded to the plaintiffs £41. The question of law he would consider, and give his decision to the registrar, after which the parties, if they thought proper, would be allowed ten days to give notice of appeal. It was a most important question, and he hoped that, whichever way he decided, an appeal would be made.

GREENWICH POLICE COURT.—WEDNESDAY, JULY 22.

(*Before Mr.* BALGUY.)

THE LEWISHAM DISTRICT BOARD OF WORKS *v.* THE PHŒNIX GASLIGHT AND COKE COMPANY.

SULPHUR IMPURITIES IN GAS.

Mr. EDWARDS, clerk to the district board, appeared in support of the summons: the company were defended by Mr. BESLEY.

Mr. EDWARDS: This, sir, is a summons taken out by the Lewisham Board of Works against the Phœnix Gaslight and Coke Company, for supplying gas of a less purity than it ought to be, in accordance with the provisions of the Phœnix Gas Act, and of the Acts incorporated therewith. The principal Act incorporated is the Metropolis Gas Act, 1860, by the 25th section of which the illuminating power of the gas is prescribed. It is also by that section enacted that, "with respect to its purity, it shall be so far free from ammonia and sulphuretted hydrogen, that it shall not discolour either turmeric paper or paper imbued with acetate or carbonate of lead, when those tests are exposed to a current of gas issuing for one minute under a pressure of five-tenths of an inch of water, and shall not contain more than 20 grains of sulphur in any form in 100 cubic feet of gas." It is on this provision, that it "shall not contain more than 20 grains of sulphur in any form in 100 cubic feet of gas," that this summons is taken out. The Act proceeds to provide for a penalty of £50 in the event of the gas not being supplied in accordance with this standard. It also provides for the appointment by the local authority of a gas examiner, and for his examination of the gas and report thereon. The Board of Works for Lewisham have appointed Mr. Heisch as the examiner for that district, and in pursuance of directions to him, he, on the 5th and 6th of May last, examined the gas of the Phœnix Company, and made his report, as follows:—

Report on the Quality of the Gas supplied by the Phœnix Gas Company, May 5, 1874.

Illuminating power	16 candles.
Sulphuretted hydrogen	None.
Ammonia	None.
Sulphur on the 5th and 6th	31·5 grains in 100 cubic feet.

(Signed) CHAS. HEISCH, Gas Examiner.

To the Lewisham Board of Works.

A copy of that report was furnished immediately to the company, with a request for any observations they might think fit to make upon it. In answer I received the following letter from the secretary:—

Phœnix Gaslight and Coke Company,
70, Bankside, London, S.E., June 11, 1874.

Dear Sir,—I am directed to acknowledge the receipt of your favour, with copy of the examiner's report of testing, and to convey the thanks of my board for the same.

(Signed) I. A. CROOKENDEN, Secretary.

Samuel Edwards, Esq., Clerk, Lewisham District Board of Works.

Mr. BALGUY: What is the date of that letter?

Mr. EDWARDS: The 11th of June. Upon the receipt of that letter the company were informed that, in the absence of any explanation as to why they had been supplying gas contrary to the Act of Parliament, the board had directed that a summons should be issued against them. I think perhaps it is due to the company that I should read that letter and their reply:—

The Board of Works for the Lewisham District,
Grove Place, Lewisham, Kent, June 20, 1874.

Dear Sir,—I beg to inform you that your letter of the 11th inst., with reference to the gas examiner's report forwarded to you, was submitted to the board at their meeting on Thursday last, and in the absence of any explanation of the excess of sulphur compounds beyond the statutory limit, the board have directed proceedings to be taken against your company for the recovery of the penalty thereby incurred.

(Signed) SAMUEL EDWARDS, Clerk to the Board.

I. A. Crookenden, Esq., Secretary, Phœnix Gas Company, Bankside, S.E.

Phœnix Gaslight and Coke Company,
70, Bankside, London, S.E., June 25, 1874.

Dear Sir,—I submitted to the board of directors yesterday your letter of the 20th inst., in which you state that "in the absence of any explanation of the excess of sulphur compounds beyond the statutory limit, the board have directed proceedings to be taken against your company."

In reply I am to assure you that every effort is being made to reduce this compound to the lowest possible per centage which the existing apparatus can effect. The directors would feel happy if a committee of your board would favour them with a visit to their works at Greenwich (from which Lewisham is supplied), where the whole apparatus and the means adopted to extract the sulphur could be explained to them. The directors admit that it is possible to keep the quantity of sulphur within the prescribed maximum of 20 grains, but this, it is feared, can only be done by a most costly rearrange-

ment of the existing plant, and the board are anxious to avoid any outlay which might necessitate an increase in the price of gas.

I am further to remind your board that practically the difference between the 20 grains of sulphur permitted, and the quantity the gas usually contains is in effect of the most insignificant importance.

The engineer, however, is now specially engaged in bringing, if possible, the quantity within the prescribed limit, and it is hoped with some chance of success.

The directors trust that this explanation will so far satisfy the Lewisham Board of Works as to induce them to withdraw from any hostile proceedings.

(Signed) I. A. CROOKENDEN, Secretary.

P. S.—I may add that the directors had no idea that a reply to *this particular* point in your favour of the 1st, was expected, or the above statement would, of course, have been made at once.

Samuel Edwards, Esq., Clerk, Board of Works, Lewisham, S.E.

The board disclaim any hostile feeling in this matter.

Mr. BESLEY: The next letter is the one I should rely on.

Mr. EDWARDS: I am going to read it. I was about to say that the board disclaim any hostile feeling towards the company. They do feel, under the circumstances, that a duty is imposed upon them; and, notwithstanding that letter and the intention expressed of the company in it, they consider themselves bound to take these proceedings. I so informed the company, and I subsequently asked them whether the report of Mr. Heisch was admitted. In reply, I received this letter, dated July 8.

Mr. BESLEY: There is first of all a letter of the 28th of June.

Mr. EDWARDS: You can read that when your time comes.

Mr. BALGUY: It would be better for you to make a continuous story by reading it now.

Mr. EDWARDS: I think not. It is a letter addressed by me personally to the secretary. If the learned counsel chooses to bring it before the court, he can do so.

Mr. BALGUY: The learned counsel says it is part of his case.

Mr. EDWARDS: That may be.

Mr. BESLEY: My friend has just read the explanation of the directors, in which they say they hope, after this explanation, you will not proceed with your threat. "The directors trust this explanation will so far satisfy the Lewisham Board of Works as to induce them to withdraw from any hostile proceedings." On the 27th of June there was a letter sent by Mr. Edwards, clerk of the board, as follows:—

The Board of Works for the Lewisham District,
Grove Place, Lewisham, Kent, June 27, 1874.

Dear Sir,—I beg to acknowledge the receipt of your letter of the 25th inst., which will certainly remove an impression held by the board, when they passed the resolution communicated to you, that your directors did not recognize any obligation upon them to reduce the amount of sulphur compounds. Your letter will be laid before the board at their meeting on Thursday next, and I entertain but little doubt that I shall have the pleasure to receive directions to withdraw the summons which has been issued.

(Signed) SAMUEL EDWARDS, Clerk to the Board.

I. A. Crookenden, Esq., Secretary, Phœnix Gas Company, Bankside.

Mr. EDWARDS: That is a letter from me personally to the secretary. There is a letter from the board dated the 3rd of July. Do you propose to read both letters?

Mr. BESLEY: I will read both if you like. I wish the magistrate to have this in his mind. Mr. Edwards, in his letter, says: "I entertain but little doubt that I shall have the pleasure to receive directions to withdraw the summons which has been issued." That is all I want you to have before you.

Mr. EDWARDS: Mr. Besley is entitled to the full benefit of my anticipations, which have not been carried out, no doubt for very good and sufficient reasons—at any rate, they were such as the board were satisfied with when they directed these proceedings to be taken. In reply to the letter asking whether Mr. Heisch's report would be admitted, I received a letter from the secretary, in which he says: "In reply to your letter of the 6th inst., we are prepared to admit the correctness of Mr. Heisch's report as to the quality of the gas supplied by this company on May 5 and 6 last." Upon that admission I ask you to convict the company of having supplied gas which was not in accordance with the provisions of their Act.

Mr. BESLEY: I understand my friend is going to ask you to put in force a very penal Act, upon a letter——

Mr BALGUY: I think he should prove his case.

Mr. ELWARDS: If you think so, sir, I shall put Mr. Heisch in the box.

Mr. *Charles Heisch*, examined by Mr. EDWARDS.

You are the gas examiner appointed by the Lewisham Board of Works?—YES.

Did you examine the gas supplied by the Phœnix Company within the Lewisham district on May 5 and 6 last?—I did.

Will you state what was the result?—The result was that it contained in 100 cubic feet 31½ grains of sulphur.

Although the examination occupied two days, I presume it was only one examination?—The test for sulphur goes on for 24 hours, so that, if necessary, it extends into another day.

You light the gas one day, and allow it to burn 24 hours. Therefore, in saying the sulphur on May 5 and 6 was in excess, it was the result of one examination?—Yes; we get a fair average sample of the gas delivered in the 24 hours.

Cross-examined by Mr. BESLEY: Where did you make the test?—At the testing-station in Elizabeth Row, Greenwich.

Is that the testing-station where the experimental meter has been put up?—Yes.

Did you give the company three hours notice of your test?—I did not, because the company wrote a letter expressly to say they did not wish to have it.

When the letter is produced we shall be able to deal with it. At all events, you must not give us the contents of a letter not produced. You say you did not give the three hours notice required by section 23?—No.

Have you been long the examiner appointed by the local board?—No.

How long have you been so?—I was appointed at the end of last April.

Was this the first test you ever made?—At this place?

At the place where the experimental meter is?—Yes.

And this is the only test you ever made there?—The first test I made there.

Have you made any since?—Yes.

How many altogether?—I have only made two.

Two since?—No; only one since.

Have you ever been gas examiner for any other local authority?—I am the superintending gas examiner in the City of London.

How long have you been in that office?—Six years.

You are aware, therefore, of the legislation with reference to gas?—Certainly.

In the City of London you are aware that the Act of 1868 applies?—Yes.

And that there proceedings under the Act of 1860 are altered by the Act of 1868?—Yes.

There is no longer in the City of London, and in such other parts of The Gaslight and Coke Company's district as are within the operation of the City of London Gas Act, any such thing as gas examiners?—Yes, there are.

But the gas referees fix the amount of impurity in the gas?—Yes, they fix the amount of impurity.

That is, the referees under the Act of 1868?—Yes.

You are, of course, familiar with the words in the 26th section of the Act of 1860—"Provided that such police magistrate shall not convict under this section, if it shall be proved to his satisfaction that such defect of gas was occasioned by any unavoidable cause or accident?"—Yes, quite so.

This was one test, though spoken of as on the 5th and 6th?—Yes, one test extending over both days.

You are familiar with the reports of the gas referees?—Yes, quite so.

Mr. BESLEY: They say: "In the Act of 1860, which prescribed a sulphur maximum of 20 grains per 100 feet of gas, legislation took 'a leap in the dark,' the real quantity of sulphur existing in the gas being then unknown, and the causes of its presence in the gas being most imperfectly understood?"—Yes.

Do you concur in that?—No, not at all.

Mr. EDWARDS: What are you reading from?

Mr. BESLEY: I am reading from the gas referees' report on sulphur.

Mr. EDWARDS: What is the date of it?

Mr. BESLEY: 1870. "Presented to both Houses of Parliament by command, July 13, 1870." I will read you another passage: "The referees have examined the various methods hitherto proposed, as well as those at present in use, for purifying gas from sulphur. The obstacle to the practical adoption of many of the proposed methods or patents of this kind has hitherto been, either that they inordinately diminish the illuminating power (the prime and fundamental quality of gas), or else the beneficial effect, which they show when tried on the small experimental scale alone possible for inventors, disappears or becomes wholly unreliable, when they are applied in the only practicable form—viz., on the large scale required in the manufacturing process of gas-works." Do you agree with that?—No; I cannot say I do.

May I take it you entirely differ with the gas referees on the subject?—Entirely with that report.

Are you aware that experiments have demonstrated that sometimes after using the lime process the gas comes out with more sulphur in it at the outlet than it had at the inlet?—Not if properly used.

Are you aware that there are repeated demonstrations of that kind?—Not when the lime is properly used.

You think it all depends upon that?—Yes.

You have had no practical experience in making gas?—Not in making it, but I have seen a great deal of the purification of it. You are aware that there is a subsequent report of the gas referees.

I am aware of the report of 1872, and I will read a paragraph from that: "The sulphur impurity in the form of bisulphide of carbon, or, to speak with greater certainty, in other forms than sulphuretted hydrogen, stands on a wholly different footing, for hitherto it has baffled the ablest and most experienced gas engineers, aided by the gas chemists, to eliminate it from gas, or even to devise any certain method by which it can be materially reduced and efficiently controlled." Do you agree in that?—Quite so.

In this case there was no sulphuretted hydrogen or ammonia?—No.

Those are the impurities to which the strongest objections apply?—I am not prepared to state that.

Will you stake your professional reputation that sulphuretted hydrogen is less baneful than the sulphur compounds?—A minute trace of sulphuretted hydrogen I do not consider more so.

I ask you, do you mean to represent that sulphuretted hydrogen is not more baneful than the sulphur compounds?—No; I do not think it is.

You really mean, on your professional reputation, to say that?—It depends upon what you mean. If you mean that if a person inhales sulphuretted hydrogen it will do him no more harm than inhaling sulphur compounds, then I say it will; but if you mean that, supposing the two gases are burned in a room, the products of combustion are more baneful in the one case than in the other, I say it is not.

Are you aware that upon combustion, 20 grains of sulphur will produce 40 grains of sulphurous acid?—Yes.

Is that in bulk rather more than 58 cubic inches?—That I cannot say from memory; but I dare say it is so.

Then 20 grains of sulphur in burning would produce 58 inches of sulphurous acid?—Yes; but a good deal of sulphuric acid will be produced at the same time.

An ordinary fishtail burner consumes 4 cubic feet of gas per hour?—Yes.

In six hours, 24 feet?—Yes.

Two of these burners consume 48 cubic feet in six hours, and would produce 28 cubic inches of sulphurous acid?—Yes, provided it is all converted into sulphurous acid, but a good deal of it is converted into sulphuric acid, which is a different thing.

Will you agree that in an ordinary sized room that would be 1-86 thousandth part?—That would depend upon the size of the room and the number of burners.

We are talking of its being consumed, and not escaping?—No.

You think that would be right?—It would depend upon the size of the room and the number of burners.

A room 12 feet by 10?—I am willing to take your figures if you have gone into them.

Assuming the atmosphere was not changed at all, this would be about an 86th thousandth part in six hours?—Yes.

But you know there is no room in which the atmosphere is not changed constantly?—Yes.

Would not the burning of coal in a common grate produce more sulphurous acid than that quantity of gas?—No, not if you had a chimney that drew properly; it would go up the chimney.

But, in the best of grates, you have noticed it is given out into the atmosphere?—No.

Do you say never?—I say not with a properly constructed grate. If it did, I should say a person would have his grate altered.

You think it could not happen?—I do not say that; but no one would keep a grate that allowed sulphur to escape into the room.

Are you aware that the referees are engaged at an expense of £800 a year to the companies to find out some means of dealing with the sulphur compounds?—To diminish them.

Are you aware that there has been absolutely, since the Act of 1860, no conviction in reference to sulphur impurities?—Yes; I am quite aware of it.

Mr. EDWARDS: There was one the other day in this court.

Mr. BESLEY: I say that was through the folly of the Crystal Palace District Gas Company in not being properly represented; and then it was only 1s., and perhaps it was the smallness of the amount which induced them to submit to it. (To witness:) You have no opinion on the matter?

Witness: I must answer that more minutely. When the referees were appointed in 1868, they reversed the Act of 1860, and fixed no maximum for sulphur. Since they have fixed a maximum, which is the same as that fixed by the Act of 1860, the gas supplied by the companies under their control never has had 20 grains in it; therefore, there has been no chance of getting a conviction. But I can say this positively, had the gas supplied to the City of London contained 20 grains since that maximum was fixed, there would have been a prosecution certainly.

You ought to deal fairly by the magistrate. Are you not aware that with regard to Beckton, which is out of a densely populated neighbourhood, the referees have fixed a different maximum?—Yes. Beckton and Bow.

Are you not aware of this particularly?—I say at Beckton and Bow.

Are you not aware that in fixing the maximum—a different maximum—they have been influenced by the fact that gas companies cannot get rid of the sulphur compounds without creating nuisance in a dense neighbourhood?—I believe the referees think so.

They have acted upon it?—Yes.

And do not you know that instead of 20 grains they allow 30 in the winter and 25 in the summer?—In urban works.

For all the works except Beckton and Bow?—All under the gas referees.

With regard to Beckton, you do not carry on any test for sulphur?—They are all carried on under my direction.

Are you aware that it is impossible at times to prevent sulphur in the gas?—You may have an accident—a breakdown—sometimes.

From causes which cannot be ascertained?—No.

How many times this year has the Chartered gas had more than 20 grains?—I am speaking from memory, and will not say positively, but I should think not once.

Though you are the superintending examiner, you do not know the fact?—Oh, yes I do. If you had wished to have the books, I could have produced them; but I cannot say that on any particular day they have.

You do not think this year they have?—Yes.

Do you think not?—I have only two occasions in which they have exceeded since the 20 grains was fixed.

With regard to Beckton and Bow, it is because they are not in dense neighbourhoods that they can thus purify without nuisance?—They can purify without nuisance.

If Beckton were in London, could the purification go on without creating a nuisance?—I am not prepared to say that it could.

Re-examined by Mr. EDWARDS: You have been asked if you made a second examination, but you were not asked what was the result of the second examination. Will you tell the magistrate what the result was?

Mr. BESLEY: We are not summoned for that, and I object to the question as to what is the result of another examination.

Mr. EDWARDS: It is represented to the court by the tenor of the cross-examination, that it is impossible to produce gas with less than 20 grains of sulphur. If the learned counsel is right, perhaps the magistrate, for his own information, will ask the question.

Mr. BALGUY: What was the result?

Witness: The result of the second examination in July was, "Sulphur compounds, 16 $\frac{7}{10}$ grains."

Mr. BESLEY: Well, that is in my favour.

Mr. EDWARDS: I think it is in my favour too. (To witness:) You have been asked whether you know of any conviction. Do you know whether any or many gas examiners have been appointed under the Act of 1860?—That I cannot answer. I was speaking of convictions in the metropolis merely.

Mr. EDWARDS: We are in the metropolis here, and I believe the absence of convictions is due rather to the absence of gas examiners being appointed.

Mr. BESLEY: Do not give us evidence yourself.

Mr. EDWARDS: Are you aware of the fact?

Witness: There have been in the City; I do not know whether there have been anywhere else.

Mr. BESLEY: You do not pretend that there has been any conviction in the City of London for sulphur compounds?

Witness: No. I say a gas examiner has been appointed in the City.

Mr. BALGUY: What is the date of this summons?

The CLERK: June 27.

Mr. BESLEY: The allegation of impurity in the gas being on the 5th and 6th of May. Now, sir, I submit to you in the first place, in order that you may have the point before you, that by the Act of 1860, it is not competent for the local authority to come to a magistrate's court. That question has been raised before, and would have been reserved, but for the dismissal of the summons. The provisions of the Act are very strong, and give to the local authority the power to go to the Secretary of State if they have any complaint to make with regard to the carrying on of the company's works. Section 7 is in these words: "If at any time complaints as to the quantity or quality of the gas supplied by any company be made to the Secretary of State in writing from the Metropolitan Board of Works, or any vestry or district Board of Works, signed by their clerks respectively, or not less than 20 inhabitant householders paying rates for, and supplied with gas, by any such company, it shall be lawful for the said secretary at any time within one month after the receipt of such complaint, to appoint a competent person as inspector to inquire into and concerning the grounds of such complaint and to report to the said secretary thereon." This provision is in strict accordance with the 30th section, the marginal note to which is, "Complaint, to a magistrate as to supply of gas." The section says: "The examiner, on payment to him of a fee of 10s. 6d. by any consumer, shall, at his request, examine and report to him on the illuminating power and the purity of the gas supplied as hereinbefore mentioned; and any consumer may make complaint to any magistrate with respect to the illuminating power or purity of the gas supplied to the complainant, and the magistrate may entertain and hear the complaint, and proceed thereon according to the provisions of this Act." Here is the inclusion of the one and the exclusion of the other—that is to say, the last clause, by expressing in words that "the magistrate may entertain" the complaint of the single consumer, and the former clause by saying that the complaint of 20 consumers, or of local boards and vestries, shall be taken to the Secretary of State shows that it was the intention of the Legislature that there should be no internecine quarrels between local authorities and companies before the magistrates. It is a very reasonable provision. A consumer who has cause to complain of annoyance from the supply of gas to him can come to you, and you are to exercise your jurisdiction; but, with regard to the whole scope of the Act, you will find that complaints before a magistrate are limited by that section. The other point I have to mention is founded on the 28th section, which says the gas examiner shall give three hours previous notice to the secretary or engineer of the company of his intention to test the gas, which was not done in this case. I say, supposing I am wrong, and you should hold that the first point is not a good point, and that the local authority can come to you, there is a condition precedent—viz, that there is to be three hours notice given to the company before the test relied upon takes place. That is distinctly proved not to have been done, and therefore the complainants are not entitled to your judgment in their favour. I am bound to say that these two points, which I have shortly put before you, I have taken in my legal capacity only, for the Phœnix Company are anxious that you should have evidence before you.

Mr. BALGUY: With regard to the first point, how do you reconcile that with the 25th and 26th sections?

Mr. EDWARDS: And with the 30th. The Board of Works is a consumer.

Mr. BESLEY: With regard to the 25th section, I reconcile it, and say it supports my argument.

Mr. BALGUY: I think not.

Mr. BESLEY: I am quite sure, if you look at it keenly, you will see that the Legislature, in the 25th section, are setting out what they require, and they say that if the local authorities require another sort of test, they may agree upon it, "provided that any gas company and the local authorities of the district supplied by such company shall be at liberty to agree upon any other or different test by which to ascertain the purity of the gas or to vary the amounts of ammonia or sulphur in any form hereinbefore allowed, and thereupon the company shall be thenceforth liable to have the purity of their gas tested in the manner so prescribed." That clearly shows that they may, by agreement, agree upon a different standard; and, if they had agreed upon 30 grains, no consumer can come forward and get another standard.

Mr. BALGUY: But the 26th section says: "If the gas supplied by the gas company be at any time of less illuminating power or of less purity than according to this Act it ought to be, the gas company shall for every such offence, on a summary conviction before a police magistrate, forfeit a sum not exceeding £50——"

Mr. BESLEY: That is the power for you to convict if a consumer makes a complaint to you, but that also supports my contention—"If the gas supplied"—it must be supplied to some one. It is not for the board to come here and say the gas was deficient in purity. They do not give any evidence to show that they are supplied with a single foot. "If the gas supplied"—supplied to whom?

Mr. BALGUY: This section follows the 22nd and 23rd, &c.: "Gas companies to light streets when required by local authority." "Local authority may provide lamp-posts and lamps." "Service-pipes to be fully charged with gas." "Illuminating power and purity of gas;" and then there is what local authorities are to do.

Mr. BESLEY: This is what they have to do. By the 25th section they are by agreement with the gas company, to alter the amount of sulphur and the mode of testing, and there is a provision afterwards for an appeal to the Secretary of State. The 26 section distinctly provides that for every offence on summary conviction the company are liable to a penalty of £50, and whether that penalty is recovered or not—*i.e.*, whether the consumer succeeds or not, there is a further sum of £10 for every day after notice in writing from the local authority during which the offence continues. But until the consumer has brought the company before a magistrate, the local authority have no power.

Mr. BALGUY: The local authority are consumers.

Mr. BESLEY: But they are not sueing in that capacity.

Mr. EDWARDS: They do not state in what capacity they sue.

Mr. BESLEY: I say the consumer only has a right to come before a magistrate; the local authority must go before the Secretary of State.

Mr. BALGUY: You have another point—you say you must have three hours notice of the test.

Mr. EDWARDS: I was not prepared for that objection, but I shall be able to satisfy you that there was a distinct withdrawal of the requirement for the notice.

Mr. BESLEY: I stated that I took these objections, as the legal adviser of the company, and, having mentioned them, I do not withdraw them. If necessary I shall still rely upon them, but I shall now go to the merits, and I think I may abbreviate my remarks because every one has some acquaintance with gas matters. With regard to the Phœnix Company, you are aware that their place of manufacture is at different points, and that one of them is within the area of the metropolis, and the whole of them in the midst of dense populations. Then with regard to the Act of 1860, the clause with reference to the purity of gas was put in, but it is obvious, from the legislation since then, that a change of opinion on the subject has taken place. The referees, under the Act of 1868, call the legislation of 1860 "a leap in the dark," and I was sorry to hear Mr. Heisch say that he differed entirely from the referees on that point. The gas referees are the highest authority in reference to this matter, and I can find passages in their report, from one end to the other, in which they say it is an exceedingly difficult thing to deal with this sulphur question, and it is quite a mistake for the public to suppose that sulphur compounds are the things that injure them. They are not injurious in any way, and I shall be able to show to you that, given a room of 12 feet by 10 feet, and given two fishtail burners consuming the full amount of 4 feet per hour—supposing these burners lighted and the room hermetically sealed up so that the air could not be changed at all, which practically could never be the case, because there are always draughts from windows and doors, and by means of the chimney—but supposing it to hermetically sealed for six hours, the 20 grains of sulphur per 100 feet would only represent the 86-1000th part of the cubical contents of the room. No wonder, then, that it has been left to the Lewisham Board to render themselves famous in their opposition to what the best scientific men of the age say. With regard to the removal of sulphur from gas, experiments have been carried on at Bow and Beckton, where they can be conducted without nuisance, both with lime and oxide. The gas was put through the oxide first and lime afterwards; then through lime first and oxide afterwards. The tests were carried on for three weeks, and on some days was free from sulphur; on other days the gas would come out with more sulphur in it than it had when put into the purifier. Sulphur compounds is a general name, and includes everything that has to be removed after the sulphuretted hydrogen and ammonia. In this case we have taken out the two latter, and there remain only the sulphur compounds, the effects of which, as I have shown, it is impossible to appreciate. And now I will tell you what has been done. By the Act of 1860 we, with the other companies, were compelled to supply gas with an illuminating power of 12 candles, and we have never been put under legislative obligation to give more than that. But in order to keep our supply equal in quality to that supplied by the Chartered and other companies who are affected by the legislation that took place in 1868, we have gone beyond our parliamentary obligations, and have voluntarily given 16-candle gas to our consumers. Until gas companies are heard, it is astonishing what an amount of prejudice there is against them, and they continually suffer from this prejudice. The Phœnix Company could give only 12-candle gas; they voluntarily give 16. Now the gas referees say that wherever there is an entire absence of sulphur compounds, the illuminating power is diminished. They also say that it is an advantage to the public to have a higher illuminating power, and the company therefore had given it voluntarily to their consumers. But in order to do this, it is a necessity, as the referees point out, to use coals which are called sulphurous coals—that is to say, they are coals that have a bad reputation for producing sulphur compounds. The referees, in one of their reports, say they cannot tell how this is, but that at the Beckton works, which are the largest in the world, it is found that some coals have the reputation for producing more sulphur compounds than others. To give the higher illuminating power, the company have to use this description of coal, and, in so doing, the Act of 1860 has fallen into abeyance, and it is a fact that until the summons last week against the Crystal Palace District Gas Company, there has never been a conviction under that Act, and I cannot for the life of me tell how it was that they submitted to an adverse decision, for they are positively excluded from the operation of that Act.

Mr. EDWARDS: They are under a special Act, and there are special clauses in that Act respecting purity.

Mr. BESLEY: At all events, they are not under this Act, and the Act of 1871 does not prescribe anything respecting sulphur compounds.

Mr. *Heisch*: Yes.

Mr. BESLEY: Well, I say there has never been a single conviction under the Act of 1860, and in the present case I shall be able to show, by overwhelming evidence, that everything has been done for the purpose of removing the sulphur compounds as far as it can be done, and it is impossible to do more without creating a nuisance. Then we come to the words of the 26th section, which are as follows:—"Provided that such police magistrate shall not convict under this section if it shall be proved to his satisfaction that such defect of gas was occasioned by any unavoidable cause or accident." What is the defect here? I am at a loss to understand. It is not in the illuminating power, for that, instead of being 12, is more than 16 candles; not in the presence of sulphuretted hydrogen, for there was none; not in ammonia, for there was none. Is there a defect because the sulphur compounds are in excess of 20 grains, as laid down in the Act of Parliament, which has been followed by others appointing referees to lay down a proper standard of purity, and which

referees have delared it impossible to adopt the 20 grains as a standard? I say that up to this hour no company have been summoned for sulphur compounds.

Mr. *Heisch:* Yes, they have.

Mr. BESLEY: I beg your pardon. They were summoned for two things. I know the case you refer to for I was engaged in it, and I say that there never was any attempt made to get a conviction against a company for sulphur compounds till this summons was taken out by the Lewisham District Board. Now, what is the evidence? That, on the occasion of one test, without notice to the company, in one 24 hours, there was found an excessive quantity of sulphur in the gas. You, sir, must be satisfied that, on that occasion, the defect was not the result of avoidable cause or accident. I say the cause was inevitable, for we should have been indicted for nuisance if we had taken out more by our purifiers. We cannot enlarge our purifiers. It is admitted by scientific men that you cannot have your purifiers more than 6 feet deep, and, if we are to use another means of taking out the sulphur, we shall poison the neighbourhood every time we take out the spent material; and all to get rid of an excess of sulphur which, if present in a room such as I have described, would not amount to the 86-1000th part of the cubical contents. I shall satisfy you of these facts, and I trust, in the result, you will see that the defect was not normal and to be punished by a fine. It may well be attributed to an accident, and when you find that the examiner of the district board has only tested on two occasions—once in May, when this defect is alleged, and again in July, when the impurity was within the prescribed limits—it is an extraordinary specimen of what prejudice will do in inducing local authorities to persecute gas companies, when we find the Lewisham District Board coming here, at the end of July, to ask the magistrate to convict for an offence which they say was committed in May, although their subsequent examination showed no defect in the gas, and although they had intimated that the summons would be withdrawn. Under these circumstances, I trust you will say, by your judgment, that you will not convict the company and impose even the smallest penalty. I trust also that the local authority will be better advised in future, and will not allow prejudice to blind their eyes to undoubted facts on a very difficult subject which has been well looked after and taken care of by the gas companies. If the companies are to be punished by penalties of £50 a day, they may as well shut up at once. I do not know how the local authorities will like that, but they must either do it or put such a price on their gas as will compensate them for these very injudicious proceedings on the part of the district board. I shall now call evidence to prove that everything has been done by us, and that we do not deserve a conviction in this case.

Mr. *T. A. Crookenden*, the secretary of the company, was then called.

Mr. BALGUY remarked that this witness was nominally the defendant in the case, as representing the company.

Mr. EDWARDS: The point upon which evidence is about to be called has only reference to the penalty, as the fact is admitted. I am prepared to take a mere nominal penalty.

Mr. BALGUY: But Mr. Besley intends to prove that the excess of sulphur on the 5th of May was from accidental causes.

Mr. BESLEY: That is to say, that it is impossible to prevent the excess—that there are no scientific means known by which these works can be carried on otherwise than they are.

Mr. EDWARDS: I understand Mr. Besley to say that you are to presume this was the result of an accident, but I say you must have distinct evidence that it was.

Mr. BALGUY: That I understand Mr. Besley to say he shall do.

Mr. BESLEY: I shall offer evidence to prove that it is quite impossible to do otherwise than we do without creating a nuisance.

Mr. BALGUY: Mr. Besley is justified in offering any evidence he can, for I must say that, as far as I see the case, it does seem rather sharp practice on the part of the local authority to take these proceedings.

Mr. EDWARDS: I am sorry that you take that view of the matter.

Mr. BALGUY: I mean to say that I think, after the correspondence with the company, the board should have made a further test before these proceedings were taken. It is a pity that a further test was not made, because the further test would have proved that what had been done by the company, in consequence of the communications from the local board, had been successful.

Mr. EDWARDS: Even now it is alleged, and you are asked to believe, that it is impossible to comply with the Act of Parliament.

Mr. BALGUY: I suppose Mr. Besley is going to prove that it is impossible, because the quantity of sulphur must vary, and they cannot confine it always to within 20 grains. It depends very much upon the coals—I can understand that—as from my own knowledge I am aware that the more sulphurous the coal is the better illuminating gas is produced from it. Then, as Mr. Besley says, when the coal is very sulphurous, there must be a larger quantity of sulphur in the gas.

Mr. EDWARDS: That may be so, and the result of getting rid of the sulphur may be a greater nuisance to the public. On that ground I made overtures to the secretary to give effect to the proviso in the 25th section, but it has not been done. The 25th section says the company and the local authority may agree upon a different mode of testing, and may vary the amount of ammonia or sulphur in any form to be allowed.

Mr. BALGUY: After the overtures had been made, the summons was taken out?

Mr. EDWARDS: No.

Mr. BALGUY: I can understand the company not accepting your overtures after these hostile proceedings.

Mr. *Crookenden:* I suggested that the summons should be withdrawn, and we would at once entertain them.

Mr. BALGUY: It is not likely the company would entertain overtures with a summons hanging over their heads. Why should not the overtures be made now, and the summons withdrawn?

Mr. EDWARDS: I will renew the overtures, if the summons is allowed to stand over.

Mr. BESLEY: No; I cannot allow this matter to stand over.

Mr. BALGUY: I quite agree with you there. If the overtures are *bonâ fide*, and it is the wish of the local authority to have the best gas, as I understand it to be the anxiety of the company to supply the best gas, I should say the best course would be to withdraw all hostile proceedings, and come to an amicable understanding.

Mr. EDWARDS: The proceedings are not hostile.

Mr. BALGUY: If I received a summons, I should think it was not friendly.

Mr. EDWARDS: The duty is imposed on the local authority. If it is shown that a greater evil would result from the gas being supplied of the purity prescribed by the Act of Parliament than by allowing this excess——

Mr. BALGUY: If the local authority discover that the gas supplied is of such a nature, and is so impure, as to be injurious to the public, then I think they have no other course than to take immediate steps against the company, but when it is proved that everything required by the Act of Parliament has been satisfied by the company with the exception of this superfluity of sulphur, which does not appear to be injurious——

Mr. EDWARDS: That is not admitted.

Mr. BALGUY: I understood Mr. Heisch, in cross-examination, to say, that the sulphur compounds are not injurious.

Mr. EDWARDS: He did not intend to convey that idea.

Mr. HEISCH: If I did convey that notion, it was not intended. If we are to go into this matter, I can bring evidence which I was not prepared for to-day.

Mr. BALGUY: Your subsequent test should have been taken before this summons was issued. It would then have been shown that the company had been successful in reducing the amount of sulphur.

Mr. EDWARDS: That may have been the result of an accident too; it may be so contended.

Mr. BALGUY: I think, if the local authority wish to show their *bonâ fides*, they had better withdraw these hostile proceedings and resume their overtures.

Mr. BESLEY: I quite understand that Mr. Crookenden is not willing to have this summons stand over.

Mr. BALGUY: I think he is quite right to have the summons dismissed or withdrawn, and not to allow it to hang over.

Mr. EDWARDS: After that expression of opinion, I will withdraw the summons with that object.

The proceedings then terminated.

Miscellaneous News.

NORTH BRITISH ASSOCIATION OF GAS MANAGERS.

TUESDAY, JULY 14.

(*Continued from page* 96.)

Mr. HISLOP returned his sincere thanks to the association for having appointed him president for the ensuing year. He was aware of his many imperfections, but he hoped with their kind forbearance to be able to carry through the business of the next year with some degree of satisfaction.

The PRESIDENT (Mr. Foulis) delivered the following

INAUGURAL ADDRESS.

Gentlemen, it remains for me now to make a few remarks in the way of opening the meeting, and they shall be very brief. Allow me, gentlemen, in the first place, to thank you for the honour you did me in electing me president of the North British Association of Gas Managers for the past year. I only regret that my numerous engagements have prevented me devoting that time and attention to the society's interests which I should much have liked to have done. At our meeting last year, in Edinburgh, I warmly supported the proposed amalgamation of this society with the British Association of Gas Managers, and while I still think there are many reasons which would render such an amalgamation desirable, there are certainly many considerations which make it preferable to maintain, if not the two separate societies, at least separate meetings. Successful gas manufacture is very much a matter of detail, and, while the general principles are the same, there are many points in the manufacture of gas of high illuminating power from cannel coal, which our friends across the border have no knowledge of, and could not well discuss; while there are also difficulties in the manufacturing of gas from common coal, of which we have no experience. I have said, gentlemen, that success in gas manufacture depends on the attention paid to details, and perhaps the younger members of our association will forgive me if I impress upon them the importance of this fact. All the operations about a gas-work should be conducted with the greatest regularity and punctuality. Clocks should be placed in prominent parts of the works, so that everything may be done at stated intervals—retorts charged, furnaces filled, pressures taken, gas tested, meters read, gasholders taken, syphons purged, and indeed the whole operations performed with military precision. I know how difficult it is for a manager to keep all things going on with this regularity, and to, if I may use the word, grind on from day to day and from night to night at the same routine work, watching trivial things, because these are just the things that may go wrong most readily, and which often lead to disastrous results; but depend upon it that that man will be most successful who appreciates most the importance of small matters. The two years which have just passed have been years of no small difficulty to all concerned in the manufacture of gas. The extraordinary high price of coal has rendered it very difficult indeed to make both ends meet, even with the increased price which, in nearly all cases, it has been found necessary to charge for gas. I am glad, indeed, to think that we have seen the worst of it. Cannel has fallen at least from 5s. to 7s. per ton, as compared with last year's prices, and there is every reason to believe that prices will fall still lower, although I think we can scarcely expect that they will this year fall to the low rates at which we could purchase coal two years ago. First-class cannels are not, in my opinion, likely to come so low, as the seams are limited, and are gradually getting worked out. Shale has been tried by many of us, as a substitute for the higher class of cannels, for increasing the illuminating power of the gas; but, so far as my experience goes, with only partial success, the expense of removing the refuse, especially in large towns, being a considerable drawback, and the small quantity of gas yielded from a ton of coal reducing the manufacturing power of the works. It has been frequently stated of late that, as the richer cannels get worked out, the quality of the gas must be reduced; and I believe that ultimately it will become necessary to lower the standard of illuminating power given in all towns in Scotland, but this cannot be done without considerable difficulty. If you use a gas of lower illuminating power, you must use an increased quantity to produce the same amount of light; and we all know that the fittings in nearly all houses in Scotland are small even for the supply of the quantity of gas necessary when cannel gas is used, and they would be quite inadequate were an inferior quality supplied. At the same time there can be no doubt if gas were consumed properly, an equal amount of light might be got from gas of an inferior quality as is now given by the generally imperfect methods of consuming it. Before this can be done, however, consumers would require to be educated up to it. In a paper read recently by Dr. Wallace, and published in the JOURNAL OF GAS LIGHTING, there is the following remark:—"I have said that the quality of the Glasgow gas is guaranteed to be 25 candles, and is in practice from 26 to 28, that is, as tested by the burner, and in the manner described in the Glasgow Gas Act, 1869. But when consumed in smaller burners, and at higher pressure, the result is exceedingly different, and I have reason to believe that the average illuminating power does not practically exceed 16 candles. We have here a loss of light that might be obtained by burners of proper construction and favourable circumstances, as regards pressure, to the extent of about 40 per cent.; and if we calculate this upon the whole quantity of gas consumed in Glasgow, we find it to represent a money value, at 5s. per 1000 feet, of about £130,000 per annum." In that paper he shows that in Glasgow, with 106,000 meters, and gas at 4s. per 1000 feet, the total gas revenue was £252,000; while in Birmingham, with only 50,000 meters, and gas at 2s. 3d. and 2s. 7d., the rental was £236,000. From this it would seem that if the same quality of gas was supplied in Birmingham, and sold at 2s. 3d. instead of 4s., it would cost the inhabitants £250,000 per annum more than they now pay for the same amount of light.

I do not know any subject more important or more deserving of the consideration of gas managers than the proper means of consuming gas of the qualities we are accustomed to deal with. We all know how much time and money has been spent by Government commissioners and by private parties to get at the burner which will give the greatest amount of light from a given amount of common gas. We know how successful these efforts have been, but almost nothing has been done in this direction with regard to gas having an illuminating power above 20 candles. The principle on which the burner of Mr. Sugg and others are constructed, and from which such admirable results have been obtained, is, that the gas should issue from the burner without pressure. The difficulty of doing this with the richer gases is the great tendency of the gas to smoke. With the

fishtail, or union jet burners, a certain amount of pressure is necessary, in order to spread the flame so as to give perfect combustion. In the testing-room, with a perfectly still atmosphere, gas may be burned from a union jet or bat's-wing at a pressure as low as 3-10ths, or even 2-10ths, but in ordinary rooms it is impossible to use pressure so low as this, as the slightest current of air causes the flame to smoke, producing blackened ceilings and unpleasant smells. I do not think that we, as gas managers, should rest contented until we are able to place within the reach of every consumer the means of obtaining the full amount of light from every cubic foot of gas consumed. It is a subject well worthy the consideration of every one of us, and I would recommend a very careful study of the paper above referred to by Dr. Wallace, in which will be found much valuable information. I think we ought to look at this as a benefit to the manufacturers, as well as to the consumers. We all know that there are great fields of cannel in Scotland, which yield from 22 to 24 candle gas, and also that many of the splint coals, worked in conjunction with gas-coal seams, yield from 18 to 22 candle gas; and that it is only where we get above these qualities that the great expense is incurred. If, therefore, we could introduce means by which the consumers would be able to get the same amount of light from a given quality of, say, 22-candle gas, as they now get from 26 to 27 candle gas, the introduction of the gas of lower illuminating power would be simply effected, and gas might be sold from 25 to 30 per cent. cheaper with as profitable a result, and the increasing difficulty and expense of getting the high-class cannels would be overcome.

As we have only a few hours to transact our business, I do not intend to take up the time of the meeting by going over the many improvements which have been brought out during the past year, especially as this has been so recently and so excellently done by Mr. Livesey, the president of the British Association of Gas Managers, the published report of which I have no doubt you have all read in the columns of the JOURNAL OF GAS LIGHTING. I shall only refer to a few of the most important, which are to be brought before our notice to-day.

We are to hear about Malam's process of manufacturing gas, and I am sure, whatever may be the opinion of the members with regard to the merits of the invention, we must all sympathize with the efforts of Mr. Malam and all others who can show us how even 100 feet more gas can be got from a ton of coal. This is what we are all striving after. We have also a number of inventions having for their object the removal of the dip in the hydraulic main. There can be no doubt that the object is a good one. Not only does it lessen the pressure in the retort, but there is another advantage which is, perhaps, not so apparent. There can be no doubt but that the tar in the hydraulic main does absorb some of the rich hydrocarbon vapours which go to increase the illuminating power of the gas; it is, therefore, most desirable that the gas should be separated from the tar as soon as possible. Dr. Wallace proposed to me the other day to make the main egg-shaped, the lower half of the egg being much smaller than the upper half, with a narrow slip between the two; into the lower half the tar would be deposited, while the gas would pass freely along in the upper half, the dip-pipe being closed by a flat valve. I think some such arrangement could be carried out with advantage. If the tar absorbs the rich illuminating vapours of the gas, it is clear that the conditions under which the gas and the tar are placed in the hydraulic main, where the gas has to force its way up through two or three or more inches, are such as will produce a maximum effect; and it should be borne in mind that no amount of vacuum will remedy this. If you have two inches of seal, the gas will have to force its way through two inches, whatever the vacuum may be. In any method which may be adopted I think it is absolutely necessary that it should be completely self-acting. It would be a very dangerous thing if it were not so.

We have also heard a good deal about the various methods of condensing and purifying during the present year, and we are to have a paper on the subject. I do not know what the paper is, but in reference to purification I would say that I have tried both oxide of iron and lime separately, and also passing the gas through lime and then through oxide; but I am certainly of opinion that where lime can be used, it is the best material for purifying gas, especially when the gas contains the large quantity of carbonic acid which is generally found in gas made from cannel coal; only the lime must have time to do its work. Slow condensation, thorough scrubbing with pure water, and slow purification by lime are, as far as I am aware, the cheapest and most efficient method of purifying gas.

In street-mains I do not know that there is anything particularly new.

There is a method of laying service-pipes, however, which I have not seen adopted in Scotland, although it is adopted by some of the London companies. The service-pipe is laid in a wooden trough, and, after the pipe is in its position, it is covered and completely enveloped in pitch. [The president here exhibited a sample to the members.] As a large proportion of leakage takes place from the service-pipes, I am quite sure you will see the importance of this. On the table before me there is a sample meter on the principle patented by Messrs. Cowan and Warner, which is certainly very ingenious. By the peculiar construction of the drum, a portion of the gas is returned and re-measured, as the water-line in the meter falls, and, consequently, the meter passes more gas than it registers, a larger quantity of gas is returned to be measured, and so the registering of the meter is maintained correct. Eight gills can be taken off this meter without affecting its registration. It is certainly very ingenious in principle.

And now, gentlemen, I will not longer trespass upon your time. I trust you will have a successful meeting, and I hope that as many as possible will take part in the discussion. We have not a great deal of time to get through our work; but while I certainly will suppress any irrelevant discussion, I do trust that no member will hesitate to express his opinions with perfect freedom. It often occurs that in expressing our opinions, and hearing those of others, we ourselves receive light on the subject; and one great benefit, I think, of such societies as this is, that our wits are sharpened by rubbing against each other, and that during discussions, ideas are suggested which, perhaps, would otherwise have not occurred to us.

Mr. MACRAE was sure that they, as gas managers, had felt great interest and no little pleasure, and, he had no doubt, some profit, in listening to the admirable practical address given by the president. He had spoken about things that were useful, and necessary, and practical. He never could think that the president of an association of any kind was doing any good to himself or to anybody when he shoots over his head and that of every other body. Their president had not done that; and he thought the members should take a lesson from the plain, practical, straightforward way in which that address had been given. He proposed a very hearty vote of thanks to the president.

The PRESIDENT thanked the association for the compliment paid him, and said the meeting would now hear the first paper.

(To be continued.)

GASLIGHT ASSOCIATION OF THE UNITED STATES.

MEETING AT CLEVELAND, OHIO, WEDNESDAY, MAY 13.

(Continued from page 916, vol. xxiii.)

After some discussion upon a proposal to establish an insurance-fund, the further consideration of which was adjourned, the association proceeded to the discussion of Mr. M'Ilhenny's paper on "Deposition of Carbon in Retorts, and Means of Preventing It." (The paper was published in the JOURNAL on the 30th of June last.)

Mr. M'ILHENNY, in answer to a question, said that he used an exhauster to obtain the results he spoke of. It was possible to obtain those results otherwise, but it was, according to his idea, entirely improbable.

Mr. WALKER: My idea in asking the question is this: Suppose we had a pressure of 5 inches, your seal would at least require to be 6 inches to be safe. Now, make it, say, 5½ inches, and by removing it a half inch you would still have 5 inches, and my question was—What great result would be got by doing away with the half inch?

Mr. M'ILHENNY: The exhauster stands between the hydraulic main and the purifiers, and there is no pressure on the retorts after it leaves the exhauster. Of course, between the exhauster and the holder, it makes no difference what the pressure is. The exhauster draws from one side and forces on the other.

Mr. PRICE: How do you run your exhauster?

Mr. M'ILHENNY: We run it at zero.

Mr. LITTLEHALES: I presume there is no gentleman present who has as much as 6-inch seal on the dip-pipes. What would be the necessity of it? Because you would not send 6 inches to the governor; therefore you would not want to have a 6-inch pressure on the gasholder. You would not want 6 inches of seal on the dip-pipes.

Mr. WALKER: I assume it is 6 inches?

Mr. LITTLEHALES: I presume no one would have anything like a 6-inch seal on the dip-pipes. I should think an inch would be ample, and therefore, if that were the case, there need be but little deposition of carbon in the retorts. One reason why I find there is a great deal of deposition is the manufacture of the retorts themselves. A retort that is well glazed will not have anything like the same amount of carbon deposit. Then again, in a retort that is kept well stopped, there will not be as much deposition as in one that has a great many holes in it. My experience is that having the exhauster about level gauge, with about an inch seal on the dip-pipes, there will be very little trouble with carbon in the retorts, unless the heats are very high. I do not consider that high heats are more advantageous than exceedingly low heats, because though with high heats you get a little larger production, you get the purifiers fouled quicker. I would like to ask Mr. M'Ilhenny what is the production of gas from coal in his works?

Mr. M'ILHENNY: It is beyond 5 feet considerably. Last year we used about 75 per cent. of coal from Western Virginia, about 20 per cent. from Pittsburgh, and about 5 per cent. of Western Virginia cannel. The illuminating power averaged 15¾ candle power. We sold about 17 bushels of coke to the ton. The production entirely depends upon the kind of coal you use. Western Virginia coal produces less coke, although of a better quality than that produced by Pittsburgh coals—about 36 bushels to the ton, and the Pittsburgh coal about 42 bushels to the ton. The West Virginia coal will not produce as much as the coal from Pittsburgh, and there would be no advantage in getting it. There is a cannel coal from West Virginia—a very fair cannel—that produces about 10,000 feet to the ton.

Mr. WALKER: I have understood from parties who use this or a similar process, that if they remove the seal from the dip-pipes the yield is very largely increased, even without using any exhauster.

Mr. M'ILHENNY: That cannot be so.

Mr. LITTLEHALES: Anybody who understands the principle can see at once that this is a false idea, yet I understand they say so.

Mr. WALKER: There is a good deal of misconception about it. In looking over a few old works, I find the hydraulic main working at 6 inches. Something like 20 years ago my attention was directed to that, and I commenced to remove the tar by drawing it off from the bottom of the main, and have continued to do so ever since, and have never had any difficulty with heavy tar when the liquid in the main was always kept at the same specific gravity.

Mr. M'ILHENNY: The process I have been speaking of does not subject the gas to the tar at all, and is not open to that objection.

Mr. WALKER: I did not make the objection in reference to the M'Ilhenny process. I state that this is a great trouble, and a great cause of carbon in the retorts, and I said that drawing the tar from the bottom of the main would be a means of preventing it, and that the fluid through which the gas passed remained all the time of a uniform specific gravity. I am just as anxious for improvement as everybody else; but when we can make a good quality of gas, 14 or 15 candle, using Pittsburgh coal, I think it is doing very well for the old process, and I cannot see the advantage of this thing.

Mr. LITTLEHALES (to Mr. M'Ilhenny): Do you seal each retort, or each bench?

Mr. M'ILHENNY: Each bench.

Mr. LITTLEHALES: That seems to be open to great objection. I believe it is very unwise for the gas manufacturer to charge the whole of his retorts at the same charge, because if you put 15 or 16 cwt. of coal in each bench you must necessarily check the heat. If you take two or three of them, then charge two or three afterwards, to equalize the heats, you will get better results. It seems to me that the process which the gentleman submitted is liable to the objection that you must charge all from the bench at the same time.

Mr. M'ILHENNY: I did not state anything about the method of doing this thing. I supposed at this time everybody understood what those details were. Each bench divided by divisions of the hydraulic main was the old way of doing it many years ago. In using this process I speak of, it is not necessary to charge the retorts all at once. If you wish to do so you can do it just as well, because the seal is put on when the retorts are being charged, and removed when the retorts are charged. You seal the bench, then charge it, and after the charge has been put in you remove the seal. The paper I read stated nothing about any special way of doing it. I was particular about that, because I happened to be perhaps the first one in this country to try this thing; and since then, if I may use the expression, there has been a perfect diarrhœa of schemes. I only submit the matter as an argument to prove the principle involved. If any gentleman can controvert these facts, to disprove the principle involved in that paper, I would like to hear him. The simple method of removing the seal and putting it on is a mechanical operation. It does not require any particular education to comprehend it. The principles involved, however, are a little deeper, and unless a person understands them, and knows their use, it would be folly for him to undertake it. Mr. Walker states it can be done and the same results can be obtained without removing the seal. Now, I would like him to show upon what theory or upon what principle, those results can be obtained with the seal on. I distinctly stated that carbon is produced, or rather, it sticks to the retorts, because of mechanical pressure. If any one can controvert that argument, I would like to hear him. The mechanical part of this contrivance is so simple, I did not think it necessary to explain it, consequently I left that part of the detail out.

Mr. WHITE: Since this discussion has commenced, I have been reviewing the experiences of the past five or six years of my life, in connexion with these questions of the advantage or disadvantage of dispensing with the dip-seal. Like Mr. Walker, I tried to make all the yield possible from the coal used, and with him found my first obstacle lay in the density of the liquor in the hydraulic main. I used means to make this liquor more limpid, and gained an increased yield. My next step was a reduction in the dip-seal in the hydraulic main, from 1½ inch to 1 inch, and further to half an inch; these latter changes gave me most gratifying results both as to yield and quality. During these trials I had gradually increased my heats to what we now designate "very high heats," heats as nearly white as possible; also in running my exhauster, I made it a point to secure a vacuum—not merely a gauge in my exhaust-room, but an absolute vacuum at the mouthpiece of the retort; thus I secured many of the good results Mr. M'Ilhenny so justly claims from the application of his theory, and found my company selling a yield per ton of 10,800

cubic feet of gas of a good illuminating power. What I had done convinced me of the value and need of some process whereby the dip might be removed, and the full advantages secured, as my results were practically but a cruder way of getting at the same thing, for as I worked, my exhauster actually drew the liquor in the hydraulic main down below the ends of the dip-pipes, so unsealing them to all intents, but not so fully as can otherwise be obtained. In further corroboration of the principle involved in Mr. M'Ilhenny's paper, it was my good fortune, in assuming charge of the works of the People's Gas Company of Brooklyn, to find a number of what is known as the Gibson valves—another contrivance for dispensing with the dip-seal—placed upon their hydraulic mains. I am thus enabled to give the results of some actual experiments made upon this theory. In some of these experiments I had the assistance of other and more skilful engineers, and the results obtained gave an increase of from one-third to one-half cubic foot per pound of coal, from 1 to 1½ candle gain in illuminating power, while the accumulation of carbon in the retorts was very much less than under the old method of working. It is but just to say that these experiments were carefully conducted in every respect, and that the results have been constantly reproduced, and are matters of record with that company, as they still use the Gibson valve, I am informed with satisfactory results. In reply to Mr. Walker's remark that some works are producing with seal as good results as are made without seal, it can only be necessary to say that works in every way similar as to apparatus show even greater variation in their productions; and so long as men differ and intellects vary in culture, just so long will special men produce greater results than the general man. Meaning no disrespect to the capable gentlemen who have preceded me in the charge of some works I have conducted, I have taken the same apparatus and secured many of the results claimed as being had alone from the use of appliances for dispensing with the seal; and yet subsequent experiment confirms my belief that I might have done better by using some such appliance. The result of my experience is that a reduction of seal, all else remaining the same, will increase the quantity and quality of the gas produced, and that a still greater gain is obtained by dispensing entirely with the seal; so far facts justify me, beyond this arises the question as to the proper means to apply, and this being, in most of its aspects, a purely mechanical question, must find, as all such queries do, diverse solutions.

The SECRETARY (Mr. De Mill) read the following paper by Mr. J. Herzog, chief engineer of the Metropolitan Gaslight Company, New York City:—

ON NAPHTHALINE.

Having been appointed at your last convention to prepare a paper on matters and questions appertaining to naphthaline, one of the residual products of the manufacture of gas, I respectfully submit the following.

Naphthaline, the existence of which, according to the latest edition of the "Book of Inventions," was first proven by Garden in 1820, comes over late in the distillation of coal tar. It is a solid at ordinary temperatures, and when pure forms large colourless crystalline plates; it has a faint, peculiar odour, is unctuous to the touch, and evaporates slowly at the common temperature of the air.

Naphthaline is not absorbed by water, but it is by the volatile and fixed oils, and by naphtha and coal tar; hence the advantage of keeping the raw gas until it is thoroughly cooled, in contact with tar and ammoniacal liquor, in a long hydraulic main.

Richer qualities of gas, containing much hydrocarbon, do not deposit naphthaline, and hence the use of naphtha as a remedy for naphthaline in the mains and service-pipes. Naphthaline is not easily decomposed by heat; it is quickly deposited by cold, forming brilliant white scales, which have a tendency to collect in the bends of pipes, and wherever there is an impediment to the easy flow of the gas.

For the gas engineer it seems most important to prevent the crystallization of naphthaline, and this, it appears to me, can be done by keeping the gas containing naphthaline in contact with the light volatile oils; though all the chemical properties of naphthaline are not yet discovered, it is a well-known fact that naphthaline shows a great affinity for light hydrocarbons. In gas generated at a low temperature, many of the volatile substances are lost in an undistilled condition, with the tar in the hydraulic main and connecting-pipes, in their liquid form, and combine with, or rather take up, the naphthaline. Under an increased heat, the greater part of these oils would form fixed gas, and consequently increase the volume of the gas manufactured. Though it is a great advantage to make use of as great a quantity of these lighter oils as possible in distilling the same to gas, we all know that all the lighter oils cannot be used up entirely in the distillation of coal, and thus it seems the duty of an enlightened gas engineer not to waste the same, but to make a judicious use of the same in keeping the gas as long as possible in contact with the gaseous vapours, and thus preventing the crystallization of the naphthaline which is contained in the gas. The lighter oils, as long as they are united, will, whenever they settle down in a condensed state, carry away a great deal of naphthaline in a liquid form, and the naphthaline will, in a pipe placed in proper descent, be carried on to the drips. The lighter oil vapours will separate from the gas at low temperature; in condensing, therefore, I fully agree with many, that the take-off pipes from the hydraulic main should be nearly on a level with the same, and should be of sufficient length. Clegg gives us as a rule, that for every inch of diameter the take-off pipe should have a length of 10 feet, the working pressure being two inches; for instance, the take-off pipe being 10 inches in diameter, the proper length would be 100 feet. By increased working pressure, they will, of course, require increased length in ratio of their square roots; but even at this rate a great deal of the lighter oils will be lost in condensation.

I have found in my own experience that those oils, if collected in a little tank and re-vaporized, will greatly diminish the tendency of the naphthaline to crystallize, and at the same time improve the quality of the gas. The form of such an apparatus would be a small iron tank, closed at the top, and placed below the level of inlet-pipe of the condenser, to which all drip water, and with it the lighter oils, must be conducted; the lighter oils will, from the nature of their specific gravity, float on the top of the tank. By passing a coil of steam-pipes through the tank the lighter oils will be vaporized, and the naphthaline will settle at the bottom, and from there can, from time to time, be let off. If, from an insufficient amount of these lighter oils, some benzine, benzole, or naphtha can be added with advantage, particularly if coal be used containing only a small proportion of these lighter oils, hydrocarbon vapours will surely liquefy naphthaline in any pipe or vessel.

A further tendency of naphthaline to crystallize will be created if gas containing naphthaline is passed from a hot to a cold place. Say, for instance, if the gas be stored in the holder, and the holder outside a building is exposed to a heat of high temperature, when let into pipes in the ground which are located in a lower temperature, naphthaline will surely crystallize, and, in course of time, will stop up the pipes more or less; or, if the street-mains are, in certain locations, laid too near the surface of the ground, and afterwards the gas be passed into pipes located in lower ground, by which a variation of temperature is created, naphthaline will have a tendency to crystallize

Mr. HYDE (Cleveland) also read a paper on the same subject, which is as follows:—

In the manipulation of the gas, in the process of manufacture of illuminating gas, one of the annoyances to which the manager is subjected is the deposit of crystallized naphthaline, and any experience had in regard to the course of its deposit, method of prevention, or removal, is sought by most managers.

That the amount of this crystallization is variable is probably evident to most managers; but a diversity of opinion exists as to the real cause of its profuse development, or else to the best method of preventing its crystallization and deposit.

Naphthaline is a white crystallizable substance evolved by the distillation of bituminous coal. When crystallized it is a very delicate film, yielding to the gentlest touch, yet, under favourable circumstances, it compacts and is capable of considerable resistance. It has a peculiar faintly aromatic odour, not unlike narcissus; is heavier than water, and is readily dissolved by naphtha.

During the 15 years of my experience as engineer of the Cleveland Gaslight and Coke Company, in the manipulation of the gas varied results have been observed. In the process of condensing and washing the gas, our usual method has been to condense first and then to wash. At one time it was thought advisable to erect a spray washer between the hydraulic main and the condensers, as is the method in many gas-works. Soon after there was observed a rapid accumulation of naphthaline in the drain leading to the tar-well, in the purifiers and pipes about the works, and also in the distributing mains in the streets. At a subsequent period these spray washers were removed and placed between the condensers and purifiers, used in connexion with the purifiers, and very much less naphthaline was crystallized. During the periods mentioned the heats of the benches were what is termed "high."

During the past cold season there was used with the common bituminous coal from 4 to 8 per cent. of cannel coal; the heats were not high, the gas was kept hot while passing from the retort-house to the condensers—about 150 feet—by encasing the pipe; the condensation was very gradual, by the use of an open air condenser, and but a small amount of water used in the scrubber, and no spray washer. During this period we had no crystallized naphthaline.

It has always been observed that wherever high heats were carried more naphthaline was crystallized than with medium heats, and that when a bench was lightly charged, after being cleaned of carbon, and while hotter than usual, naphthaline appeared more abundantly than under ordinary circumstances.

My deductions from the experience at our works are as follows:—The crystallizing of naphthaline is caused, first, by "high heats," and the amount increased by rapid cooling of the gas by contact with cold water, cold pipes, and rapid cooling otherwise, and that naphthaline is more likely to be developed in gas made from slack coal than from lump coal. The remedy I would suggest for this annoyance is the use of a small per centage of cannel coal in connexion with the common bituminous coals, moderate heats, long exposure of the gas to hot pipes, or other condensing operations, before reaching the cooling condenser; slow cooling of the gas, and scrubbing with a small amount of fresh or ammoniacal water of moderate temperature; and also, when found necessary, the introduction of a small continuous supply of naphtha into any horizontal pipes about the works, after condensation, or into the drips of the inlet and outlet pipes to the gasholders. The evaporation of the naphtha will dissolve the naphthaline crystals.

My deductions may not all be strictly correct, but my observations lead to these results.

Mr. WALKER: I would like to ask Mr. Hyde as to the result.

Mr. HYDE: I can hardly answer that intelligibly. We have got big results this last winter, for the reason that we were running without seal.

Mr. WALKER: What yield did you get?

Mr. HYDE: The yield has been very much greater since removing the ½-inch, and heats just as high. I cannot give from memory the exact figures.

Mr. WHITE: Upon the subject of naphthaline, I had some troublesome experiences before learning its nature. High heats have been so constantly upbraided as the parent of this *enfant terrible*, and so thoughtlessly and unjustly, that I must try to rescue them from blame. I admit that high heats undoubtedly place us in position to be annoyed with this crystal, but so did the use of steam put us in jeopardy from railway accidents. Of late years we have been putting our brain work into our retort-houses faster than in our other apparatus, and the result is the unfortunate under dissection. High heats, low seals, rapid evolution of the gases, their hasty removal from the retort, and their sudden plunging at a high temperature into the showers of spray washers, or through yards of chilling condensers, soon gave birth to the lusty and troublesome crystal nuisance that sheds its favours, like some divine blessing, upon the just and unjust, causing gas managers to drop into profanity. The agency of heats in producing naphthaline lies simply in converting into a gas, at a high heat, oleflant qualities that at low heats pass over as oils. In order to retain this (at that point) easily condensed volatile oil in a gaseous form, three methods are open to us: We may mix free hydrogen with our coal gas at a high temperature; we may introduce into our coal gas, gas made from naphtha; or adopt the plan of having a long connecting main, protected from the atmospheric changes, between the hydraulic main and condensing apparatus, so retaining the crude gas as long as possible in contact with its own condensable vapours, and subjecting it to a gradual lowering of temperature. I have made a practice of introducing the water into my condensers at the "outlet" end and taking the overflow from the "inlet" end, so causing the gas to come first in contact with pipes somewhat higher tempered than I could otherwise do, and so continuing my scheme of gradual cooling. I use but little water in actual contact with the gas, believing more in the efficacy of the dry scrubbing it gets in passing the divisions of the washer, than in water as a cooling agent in that stage. (I may say, parenthetically, that since my visit to Cleveland I believe less than ever in the virtues of water.) Following these general views, I have succeeded in escaping any further trouble from naphthaline, save an occasional warning presence in my purifiers, when I accept the hint, and look for something wrong at back of them. When gentlemen come to understand the chemical laws governing the deposit of naphthaline, the great step to its prevention will have been taken, and it will pass out of the category of nuisances, and be blessed for its useful qualities.

Mr. M'ILHENNY: I must say that I endorse, to a great extent, what Mr. Hyde says as to naphthaline. I find that the promotion of crystallization of naphthaline is always at a point where the temperature is very much colder than the point from which it leaves the holder. The gas does not change its condition after it goes into the holder, and I do not think the theory which Captain White advances, that coming in contact with its own constituents for any great length of time, will prevent its changing its condition by the condition of the atmosphere; for instance, you run a quantity of gas from a point—say at 80°—when the sun is hot, in the spring of the year, and into the ground; say that it is then 30° where the gas strikes the service-pipe, close upon where it enters the building, the volume in the service-pipe not being so great the moment crystallization takes place. I think the condition of the gas is not changed by its contact with other constituents of carbon. We ought to acknowledge that high heats convert these light carbons into gas, instead of leaving them in their original condition. My theory is that when these light carbons are converted into gas, it is done by high heats; that if you can distribute it in an even temperature, you leave no naphthaline; but if you cannot—if the temperature of distribution varies—then I think you cannot prevent it.

Mr. WHITE remarked that the writer exactly coincided in the observations he had himself made—viz., that the pipes from the hydraulic main to the condenser should be kept at an even or gradually lowering temperature. Clegg laid it down that the length of such a main should be 10 feet for every inch of diameter you have in the hydraulic main. He (Mr. White) found such a rule to work well enough in practice, and recommended it.

Mr. LITTLEHALES said he had had some little experience in naphthaline, and that experience was precisely the same as that of the writer of the paper first read, and Mr. White as to the cause of it; but there was one little discrepancy, as it appeared to him, in Mr. White's statement. He said that high heats were the cause of naphthaline; he also said that he could not get the heats too high

to suit him, and yet he argued that they should try to prevent the formation of naphthaline. The two things, it seemed to him, were diametrically in opposition to each other. If a high heat was the cause of naphthaline then let them have lower heats.

Mr. WHITE: I was combating that theory.

Mr. LITTLEHALES: I believe it was Dr. Letheby who called the attention of the British Association to the fact that tar had a great affinity for naphthaline, and that if engineers would only keep the gas long enough in contact with the tar it would remove the naphthaline from the gas. I believe that has been tried, and been found to be a perfect success in every case. We once had a great difficulty with naphthaline. The cause was this: We were working at exceedingly high heats, and the condensing power was very inefficient. The engineer of the company, Mr. Cathels, had put up not much less than 300 feet or 400 feet of pipe round the retort-house; following that was a battery condenser, which differed from anything I have seen yet in this country. It was constructed of 14 rows, with plates each 4 feet wide, 3 feet deep, and 18 feet high, with pipes across it through which the air passed. The advantage of the battery condenser is that the gas comes in contact with the tarry surface, by being tumbled backwards and forwards amongst the pipes in its passage up and down. From the time we had the condenser started we were never troubled with naphthaline. The removal of naphthaline can be entirely and completely effected by keeping it in contact with the tar.

Mr. WALKER: I cannot understand this idea of keeping low heats to prevent naphthaline. Low heats will reduce our yield. Our business is to get all the gas, and the best quality we can, from the coal; study carefully the combinations formed during the distillation, and apply them to their proper use. Naphthaline, being composed of hydrogen and oxygen, is a light-giving substance—not to destroy, but to preserve and utilize. I have never been troubled with any accumulation in my hydraulic main since. Some 20 years ago, I adopted the plan of drawing the tar from the bottom. I have found this a complete preventive; and when I want to empty it, I just turn down the pipe, and let it run perfectly clear.

Mr. HYDE (to Mr. White): Did I understand you to say that high heats are the cause of naphthaline?

Mr. WHITE: I say that high heats are indirectly the cause; they render its appearance possible.

Mr. LITTLEHALES: That is to say, although naphthaline is generated, he removes it in the way I suggest. The naphthaline is taken out by the tar.

Mr. WALKER: That is my theory of it. Mr. White's idea of the naphthaline question is this—that with high heats we produce it, but with care and chemical knowledge converted it into a permanent gas, increasing our yield, and at the same time preserving a high standard as to quality.

Mr. NETTLETON: As I regard it, and as other gentlemen expressed themselves, high heats are necessary in all cases to generate naphthaline. But my idea of naphthaline is that it is a vapour running along with the gas, and is not a gas itself; and that if you run it along with the other elements of the gas until the gas is properly and gradually cooled, there are certain elements which keep that vapour in contact with the gas, and carried forward with the gas into the holder, and from the holder into the burner, and forms an element of light when the gas is consumed at the burner. I am no chemist, but that is what I understand to be the nature of it.

Mr. WALKER: In corroboration of Mr. Nettleton's ideas, I will state that, about a year ago, I was remodelling an old work. I carried the collecting-pipe from the hydraulic main the entire circuit of the retort-house. Previous to this change they had been greatly annoyed by naphthaline, but since then it has entirely disappeared; and, as it does not appear to go to the tar-well, my theory is the same as that which was broached in a paper that appeared about nine years ago in the *American Gaslight Journal*, under the signature of "Out West," that naphthaline in the form of vapour, by being kept in contact with the highly-heated light hydrogen, produced at the latter end of the charge, is converted into a permanent gas.

The PRESIDENT: I do not suppose that it is necessary to say a word, but I think that all washing should be deferred until after condensation. Gas should never be washed until after it is condensed, and it should be condensed slowly, and just as little water should be used as possible.

Mr. WHITE: I look upon the use of water in washing gas very much as the Irishman did upon its presence in his receipt for making punch. He said you first get the lemons and the sugar, and just a sup of water, then plenty of whisky, then a little more whisky, then may be a trifle of sugar, and then every drop of water you put in after that is ruination to the punch.

(*To be continued.*)

NORWICH WATER-WORKS COMPANY.

The Half-Yearly Meeting was held on the 22nd inst.—Mr. H. S. PATTESON presiding.

The SECRETARY (Mr. R. Cooper) read the directors report for the half year ending the 25th of March, of which the following are the principal sentences:—

The revenue account shows that, after payment of all working expenses, and debenture interest and dividends on preferential shares, there remains a sufficient sum to pay a dividend on the ordinary share at the rate of £5 10s. per cent. per annum, deducting income-tax, leaving a balance of £230 10s. 11d. to the credit of the next half year's account. The directors have therefore declared a dividend at that rate, which will be paid to the shareholders on the 30th inst.

The works and machinery continue to be maintained in complete repair and efficiency, but the working expenses and high price of coals still affect the profits of the company, and prevent any increase of the dividends.

The CHAIRMAN, in moving the adoption of the report, said the works of the company were all in thoroughly good order, and the water supplied by the company had given great satisfaction to consumers in all parts of the city—a state of things which he thought was due to the construction of the covered reservoirs. There was one paragraph in the report which alluded to the high price of coals as being one of the causes why the dividend was not so large as might have been expected. For the information of the shareholders, he pointed out that the cost of coals during the half year ended the 25th of March last was £631 7s. 6d., whilst the average cost during the last ten years, except 1873, was but £280, or thereabouts. In 1873 the cost was £502, and in 1872 only £255. Now, however, the price of coals had been considerably reduced, and he expected that the report for the next half year would show a much more favourable result.

Mr. R. CHAMBERLIN seconded the motion, which was put and carried.

Mr. AYRIS said it gave him the utmost pleasure to be able to report that the whole of the works were in thoroughly good order—both the filters, the engine, and the reservoirs at Lakenham. He had had one of the reservoirs opened that morning, and though it had not been emptied for over three years, he could see, through 14 feet of water, every row of brickwork and the white bricks at the bottom. With the old reservoirs, it was a very common thing to clean them out once a week; but the covered reservoirs had not been cleaned for three years. There was one matter that had caused considerable difficulty. During the time the sewerage works were in progress, the company were much pressed by the local board to supply water by means of public taps in those districts where the wells had gone dry; but this supply had since been given up, and the taps removed. The fact of those taps having been fixed at all had demoralized the whole of the cottage tenants, and an enormous quantity of water was being stolen. At the time the fixing of these taps was begun, there was scarcely a case o water-stealing in the city; but now it was stolen daily by many thousands of people. The company had taken some of these people before the magistrates, who had done their best to assist them; but it was a very painful thing to prosecute people, some of whom were most respectable persons, who pleaded that in consequence of their wells having gone dry they were compelled to take the company's water in order to wash their children on Sundays. They could not proceed against the landlords; they were bound by their Act to proceed against the tenants, the clause being to the effect "that if any persons found taking the water from taps without having agreed for a supply shall be summoned, and shall be liable to a penalty." But there was another Act, which gave power to the corporation to insist upon water being laid on to every cottage where it could be put on at a charge not exceeding 2d. per week. As a rule, the tenants who had been prosecuted were living in cottages to which the water supply would cost about 1½d. or 1¾d. per week; and it was in very few cases indeed that the cost would be greater than 2d. per week. The magistrates had thrown out a suggestion that the directors should write to the corporation calling attention to the large number of persons who were without a proper water supply. The directors had written to the corporation, which letter had been laid before a committee, and deferred for further consideration. There was one difficulty in the way of the company pushing this matter with all zeal, inasmuch as it might be said they were but pushing their own trade. Still it was impossible for a company to see their property stolen without making efforts to prevent such conduct. He mentioned a case in which owners of cottages in one yard which was supplied with water, seeing the tenants of a neighbouring yard steal their water, had given notice to the company to cut off their water, and the effect would be that their tenants would also have to steal the water that they required. With this exception, everything, so far as he knew, was going on satisfactorily.

Mr. JARROLD, in moving a vote of thanks to the directors, said he thought that the drinking-fountains in the city might be made to serve their purpose in Norwich without the waste of water, by fitting them up with the description of taps to be seen at Bristol and at many railway-stations—namely, a tap which only on being pressed by the thumb liberated the water from the pipe. With such taps there would be no waste, while there would be a constant supply of water. If the company spent £100 a year in supplying the fountains by those means with water, he did not believe the shareholders would grudge the money.

Mr. PYMAR seconded the motion, and said he should be glad if Mr. Ayris could suggest a plan by which a constant supply of water could be ensured.

Mr. AYRIS said the company were in no way responsible for the drinking-fountains, which were entirely in the hands of the corporation. Whether a fountain could be supplied by a direct stream or by means of a tap depended on how it was fed. If the fountains were supplied by means of high-pressure meters put in the ground, the correct quantity of water supplied to them was not registered; but if they were fed by means of low-pressure meters, the water could be taken from the taps in any way desired without any waste. As to the suggestion to supply these fountains with water gratis, he reminded the meeting that on a former occasion, when water to the amount of about £25 was supplied to the city, some of the shareholders living out of Norwich told the directors that they objected to their giving away the property of the company, and that when they wanted to give any thing away they would do it themselves.

After some further conversation on the subject, the vote of thanks was put and carried.

On the motion of Mr. PYMAR, seconded by Mr. CUBITT, a vote of thanks was given to Mr. Ayris for the conscientious and careful manner in which he managed the company's affairs.

Mr. AYRIS, in acknowledging the vote, referred again to the question of waste of water. He said in Bristol there were a great many high-pressure meters which did not register anything like the quantity of water which passed through them; and he believed that the dividend paid by the Bristol Company was nothing so good as that paid by the Norwich Company. As to the matter of drinking-fountains, he asked Mr. Jarrold, as a member of the corporation, to procure a meeting between him and the city surveyor, and stated that he would then give every possible assistance in determining the best way in which fountains can be fixed. There were great drawbacks to the establishment of public taps, as would be seen by the case of that supplied by the company in the market-place. A tap had been supplied exclusively for market purposes, and two large houses in the market-place had given notice of giving up the water since that tap had been in existence. In face of such things, the company had a difficult task to perform.

The proceedings then terminated.

IRON AND COAL TRADES OF SHEFFIELD, NORTH DERBYSHIRE, AND SOUTH YORKSHIRE.

(FROM OUR OWN CORRESPONDENT.)

The iron trade of this town and district cannot as yet be said to have experienced any really appreciable recovery, but there are not wanting signs of a better state of things before long. It is mentioned, as an instance of this, that to-day's advices from the United States report a decided movement in trade circles at Philadelphia and other important centres of industry. Should this eventuate as is hoped, it will have a weighty bearing on the Sheffield trades, and will give them a great impetus. It is also patent that, by reducing the colliers wages, fuel ought to be put down in price very materially, and so enable iron to be quoted at figures which will prove more attractive to buyers than those now current. The foundries are all fairly well engaged, albeit several of them have been inconvenienced or altogether stopped by the interruption or cessation of fuel supply caused by the miners strike. At Staveley, however, the colliers have decided to resume work on Monday (yesterday) at the reduction of 10 per cent., leaving the remaining 2½ per cent. to be arbitrated upon. Messrs. Newton, Chambers, and Co., the well-known ironmasters and colliery owners of Thorncliffe Iron-Works, &c., are erecting large stores in South Street, Sheffield, for the show and sale of their castings and miscellaneous foundry goods. They are also erecting an additional blast furnace at the works. It is of very large dimensions, and the most modern construction. Much satisfaction has been felt and expressed in this district at the signal defeat before the parliamentary committee of the Wakefield Water Bill. At Stocksbridge, where Messrs. Fox's works are situate, the receipt of a telegram to that effect was the signal for considerable rejoicings.

Steam coal is in but moderate request at prices which are wholly nominal, but, in some cases, about 2s. per ton higher than what has lately been considered the normal rate—viz., 11s. to 12s. per ton. House coals are not greatly altered, the demand being but small.

THE NORTHERN COAL TRADE.

(FROM OUR OWN CORRESPONDENT.)

The July coal trade will close with the end of the week, and, upon the whole, it has been satisfactory. There have been large shipments of steam coals to the East, and considerable quantities of the best gas coal have been despatched to the Baltic and Mediterranean, as is usual at this time of the year. Business, however, at the least known gas coal pits is comparatively dull, with a good deal of second-class coal on offer in the market at low quotations. Household coals have been in fair demand, but there has been little or no inquiry for manufacturing coals, which are a comparative drug. Stocks continue to accumulate, and small coasting vessels are very scarce in the coal ports. There are more orders in the market than there is tonnage to take them up. Coasting freights have stiffened in consequence, and more money has had to be paid this week for small ships to load gas coal for the bye ports. Steam tonnage is, however, tolerably abundant for London and the larger rivers, and there is no change in rates for these parts.

The chemical trade of the Tyne was somewhat slack last week, though it showed some signs of improvement on Saturday. This trade recovers from its long depression very slowly.

The iron trade is firmer. In the North of England there is a better demand for foundry pig iron. Forge qualities have improved likewise. The inquiries for finished iron have been more numerous, and prices are reported to be firm for most descriptions.

During last week there were heavy thunderstorms, and much rain fell in the North of England, which has somewhat improved the prospects of the water supply, which had been extremely gloomy.

Scotch Gas Undertakings.—The Galashiels Gas Company have reduced the price of gas from 6s. 3d. to 5s. 5d. per 1000 feet, and have declared a dividend at the rate of 10 per cent. to the shareholders. The Broughty Ferry Police Committee have fixed the price of gas for the ensuing year at 6s. 8d. The working of their undertaking in the past year has resulted in a loss of £260. The Stirling Gas Company have just declared a dividend of 10 per cent. for the past year. The report presented at the annual meeting of the Girvan Gas Company just held stated that, owing to the very high price of coals and the advance on carriage of coals, and workmen's wages, there has been a deficit on the year of £19 12s. 4½d., and no dividend could be paid. At the meeting of the Stow Gas Company a dividend of 5 per cent. was declared. The directors did not see their way at present to reduce the price of gas, but recommended the shareholders to empower the directors to do so during the current year if they found that, through reduction in the price of coal, &c., they were in a position to do so. At the annual meeting of the Berwick Gas Company on the 22nd inst., a dividend of 8 per cent. was agreed upon. It was resolved to reduce the price of gas from 8s. 4d. to 7s. 6d. per 1000 cubic feet.

On a Constant Normal Flame.—The necessities of practical photometry, as well as exact scientific research, require the use of a normal flame, constant in character and uniform in results. This is far from being the case either with the generally used standard candle, the carcel lamp of definite form and size, as used in France, or the pure ethylene gas-flame used in Germany. Wartha proposes, therefore, a simple apparatus, by which he hopes to attain this desideratum. As employed in his preliminary experiments, it consists of an ordinary gun-metal cylinder, such as is used for containing the liquid carbonic acid in a Natterer's condensing-pump, placed in a tin outer vessel filled with water. To the jet is affixed a gas-burner, just below which is placed a small water manometer. This cylinder is filled nearly full with ordinary ether, and the water outside is heated to boiling. The pressure in the interior of the cylinder is, according to Regnault's experiments, 4950·81mm. and will remain constant for an hour. If now the fine screw be opened slightly, the ether vapour passes, under only three or four millimètres of water pressure, to the burner, and, being ignited, burns with a brilliant white flame, resembling that of gas. It is easy to see that an apparatus can be constructed, weighing only from 100 to 150 grammes, which will sustain, under the conditions above given, double the required pressure, and which can be placed on the balance, and its consumption obtained within a milligramme. If a burner with an opening of known diameter be used, and the estimation be made, as is now common with the standard candle, by noting the height of the flame and the number of divisions the key is turned, the character of the flame and the consumption of material may be absolutely controlled and registered. The author suggests the use of this apparatus for determining vapour tensions, especially of the more dangerous burning oils.—*Ber. Berl. Chem. Ges.*

Edinburgh and District Water Trust.—The accounts for the year ending May 15 last have just been printed. From the revenue account it appears that the expenditure for the year was as follows:—Salaries, £1747 10s.; wages, £2172 2s. 4d.; repairs, £3275 8s. 1d.; waste investigation, £183 1s. 1d.; feu duties, rents, and taxes, £3209 4s. 6d.; printing, stationery, and advertising, £308 16s. 7d.; interest, £6778 18s. 3d.; surface damages, £13 6s.; annuities, £24,542 0s. 6d.; Mid-Lothian Water Bill, £1785 14s. 10d.; law expenses, £251 1s. 8d.; expense of transfer of loan, £6 1s.; miscellaneous expenses, £696 9s. 7d.; sinking-fund on mortgages, £471—total, £45,440 14s. 5d. The receipts, including £45,736 15s. 6d. for water-rates, were £46,250 4s. 10d., to which is added £677 1s. 5d. as balance at May 15, 1873, and £2832 7s. 4½d. for arrears of water-rates at May 15, 1874. In all, the balance at May 15, 1874, amounted to £4318 19s. 2½d. The property account shows that the cash paid for wages, &c., amounted to £8324 19s. 6d. during the year, and that the balance in hand at May 15, 1874, was £590,471 3s. 3d. At the last meeting of the trust, Mr. Coyne, the superintendent, reported that several complaints of want of water in various places having been made during the previous few days, especially since the supply was reduced by 50 cubic feet per minute, and in order to test how much these complaints were caused by the want of cistern accommodation or a low pressure in the main-pipes, he on the night of the 20th and morning of the 21st inst., after street watering and industrial works had ceased, drew off the pressure to ascertain and test the pressure in these places and throughout the city, and in Leith and Portobello. He submitted a list of places showing what the pressure was during the time, the conclusion he derived from his examination being that if there was sufficient cistern accommodation in tenements or otherwise, the complaints would be much fewer. It was quite an ordinary matter to find from 12 to 18 families supplied from one cistern, which holds only as much water as barely to allow from two to three gallons per head of the inmates. He thought this matter of sufficient importance to bring it before the trustees, more especially as he found an erroneous idea prevailed among the public that the trustees alone were to blame for the individual cases of scarcity.

Lighting Railway Carriages.—The London and North-Western Railway Company have for the last few weeks been making experimental use, in one of the carriages of the Irish limited mail, of a method of lighting devised by Herr Pintsch, a well-known gas engineer of Berlin. The illuminating agent is gas made by the destructive distillation of shale or other coarse oil. This gas contains more carbon than coal gas, and burns with much less rapidity. The apparatus for manufacture occupies but little room, and is very simple and inexpensive. The gas, when made, is pumped into an iron reservoir, tinned inside, which is placed underneath the carriage; and the gas is compressed by the pumping into one-sixth of its original volume. From the reservoir a copper tube leads to a small chamber called the regulator, in which the gas expands again, and from which ordinary feeding-tubes are carried to the roof lamps. These are of very simple construction, with iron enamelled reflectors, and the gas-burner turns out on a hinge to allow the glass to be cleaned. A stop-cock on the main feeding-tube allows all the lamps in a carriage to be extinguished at once, and they are lighted from the roof without removal. The flame of the oil gas is small, absolutely steady, and affords so good a light that very small type may be read easily in any part of each compartment. The reservoir holds about eight cubic feet of compressed gas, equivalent to 48 feet in the natural state, and this quantity is more than sufficient for two journeys from Euston to Holyhead and back. Each carriage, in all its lighting arrangements, is complete in itself and independent of every other, so that there are no connexions to be made or detached in making or breaking up trains. When used on a large scale, as on some of the continental railways, the gas is compressed by being pumped by a small steam-engine into service reservoirs made out of old locomotive boilers, and from these the carriage reservoirs are filled. Experiments have been made with a view to determine the existence of danger in case of collisions or other accidents; and it has been found that when a reservoir is broken by any violence the gas either escapes harmlessly through the rent, or, if ignited, burns out in a few moments without explosion. The inventor claims for the system great economy as well as great convenience; and, as far as mere lighting is concerned, his contrivance seems to leave little to be desired.—*The Times.*

Oxygen Dissolved in the Water of Artesian Wells.—M. M. A. Gérardin has recently presented to the Academy of Sciences a paper, in which he has given the result of his experiments on the question, whether oxygen is found dissolved in water derived from certain artesian wells. The artesian wells of Grenelle, after having traversed through the entire chalk basin of Paris, brought from a depth of 548 mètres, and produced from the green sand, arrived at the surface at a temperature of 27·7° centigrade. By permission of M. Belgrand, he made several experiments on the reservoirs adjacent to Paris at the summit of the Grenelle wells. By means of a syphon he drew water at a point about 4 mètres below its possible contact with atmospheric air. Adopting a method for the analysis of the water, already described in the *Comptes Rendus* of Oct. 12, 1872, he found the following results. Meanwhile it may be stated that the blue colour which tinges the water was attacked by using hydrosulphite of soda, in measures containing from one to six litres. He came to the conclusion that there is no dissolved oxygen in waters drawn from the lower green sand, and thus the previous experiments of M. Peligot were completely confirmed. M. Gérardin next turned his attention to other geological strata, to ascertain whether the water derived therefrom contained dissolved oxygen. At St. Denis more than 20 wells are served from four distinct sources; the deepest, having a depth of 140 mètres, had a temperature of 15° Cent. It was situated in the sands of Rilly, beneath the plastic clay, and in contact with the chalk. Another source, having a temperature of 13° Cent., and a depth of 110 mètres, was situated in the lower part of the sands of Soissonnais, in contact with plastic clay. In the middle of the sands of Soissonnais, between two masses of clay, a spring was found at a depth of 80 mètres, having a temperature of 12° Cent. The upper spring, at a depth of 60 mètres, had a temperature of 12° Cent. It was situated at the upper part of the sands of Soissonnais, which they reach after leaving the diluvium, the chalk of St. Ouen, the sands of Beauchamp, and the thicker chalk. The hydrosulphite of soda test was applied to each of these waters, and it appeared that with every precaution the sands of Rilly and Soissonnais were, in respect to the water, without dissolved oxygen, like the water of the lower green sand. At Gonesse there were springing wells having a temperature of 11° Cent. These were dug to the depth of 15 mètres, through the diluvium and recent strata of the Paris formation. But in this case no trace of dissolved oxygen was found, hence M. Gérardin concludes that if proper precaution be taken, dissolved oxygen would never be found in subterranean waters, provided they be collected without ever coming into contact with atmospheric air. Through want of this precaution, the experiments of M. Payar were vitiated, when he analyzed the water of the wells of Grenelle, and apparently found about 4 cubic centimètres per litre. M. Girardin states that he has frequently noticed, in the ascending tubes, long white or opalescent filaments adhering to the sides of the tube. So long as these had no contact with atmospheric air, they remained uncoloured, even when exposed to solar light; but the instant that they came into contact with dissolved oxygen, he found that they turned green, giving thus the most refined test of dissolved oxygen in the water of artesian wells. At the same time, he remarks, under correction by M. Pasteur, that he had not ascertained the presence of these seaweed-like filaments except at a very moderate depth, where, possibly, they had existed by diffusion of an extremely small amount of dissolved oxygen. Lower down, the absence of vegetation was easily explained by the entire absence of free oxygen.—*Comptes Rendus.*

Glasgow Water Supply.—The annual report of the Water Committee of this city shows that during the past year the rates levied were the same as those of the year preceding—viz., the domestic water-rate within the city and royal burgh of Glasgow, being the limits of compulsory supply, at 8d. in the pound; the public rate within the said limits, at 1d. in the pound; the domestic water-rate, beyond the limits of compulsory supply, at 11d. in the pound; and the rates and charges for supplies for manufacturing, trade, or business purposes, according to a revised table approved of on the 19th of May, 1873.

The revenue collected during the year amounted to. . .	£118,505	3	6
The expenditure, including annuities and interest on mortgage debt, amounted to	98,941	1	10
Balance carried to sinking-fund	£19,564	1	8
The revenue for last year, as above, was	£118,505	3	6
,, for previous year was.	111,302	0	3
Increase	£7,203	3	3
The expenditure for last year, as above, was.	£98,941	1	10
,, for previous year was	98,099	5	4
Increase	£841	16	6

The sum of £19,564 1s. 8d., which has now been placed to the credit of sinking-fund, has increased that fund to £60,790 6s. 3d. The committee have resolved to continue, for the year commencing the 28th of May last, the same domestic water-rates, public water-rate, and charges for supplies of water for other than domestic purposes, as those of the preceding year. The works connected with the lochs, and with the aqueduct from Loch Katrine, are in good order, and require no repairs beyond painting and ordinary maintenance. The two additional lines of 36-inch mains from the reservoir at Mugdock to Canniesburn were brought into use for the supply of the city towards the close of 1873. The Waulkmill Glen reservoir at the Gorbals works was filled to the top water level last January. The embankment appears now to be perfectly water-tight and substantial. The average quantity of water sent into the city and suburbs during the past year has been as follows:—

From Loch Katrine.	28,231,253	gallons.
From Gorbals Works	4,033,033	,,
Together	32,264,286	,,
Average for 1872-73	51,731,303	,,
Increase per day	532,983	,,

The estimated revenue for the current year is £124,526, and the expenditure £102,630, leaving a balance of £21,896, which it is proposed to carry to the sinking-fund to the extent of 1½ per cent. on the whole. The domestic rate for the current year has been fixed at 8d. in the pound to persons within the municipality, and 11d. to those outside. The public rate continues at 1d. At the meeting of the committee on the 13th inst., the engineer (Mr. Gale) made the following report:—"Water in Store: The lochs were full at the date of my last report, and though the season has been a dry one, the recent rains have filled Loch Katrine to the top water level again. On the 4th inst. there were 106 days supply on hand of the 68,500,000 gallons a day which at present constitute the demand on the works. On the same date the Mugdock reservoir was full, and contained 19 days supply for the city. At the Gorbals works there are 123 days supply at the reservoirs. The whole flow of the stream during the last three months at these works has only amounted to one-fifth of the quantity drawn from the reservoir. Supply of Water: The average quantity of water supplied to the city and district during April, May, and June last averaged 28,600,000 gallons a day from the Loch Katrine works, and 4 million gallons a day from the Gorbals works, in all 32,600,000 gallons a day, being

800,000 gallons a day more than for the corresponding three months of 1873. It is also about 800,000 gallons a day more than during January, February, and March for this year; but a considerable increase of consumption obtains during the warm dry weather of every year. Gorbals Works: The repairs to the filters of the Gorbals works, referred to in last report, were commenced, but have been discontinued, owing to complaints having been made of the quality of the water as delivered in the city. This arose from a portion of the water having to be passed in without filtration while the repairs were going on. As 4,000,000 gallons a day are now regularly sent in from these works, the whole of the existing filters are required to pass the water; and as I have been requested recently by the works committee to report as to the supply to the high levels on the south side of the river from these works, I shall take occasion to consider the question of additional filtering area at the same time. City: During the last three months the Works Committee have authorized the laying down of 2¼ miles of distributing-pipes, and of 1076 yards of main-pipes, from 6 inches to 15 inches diameter, the latter being principally for affording an increased supply of water for the extinguishing of fire. The number of water-taps and fittings examined in the ordinary course of inspection in the city and district, during the last three months, has been 58,302. Of these, 3240 were found in bad repair, being at the rate of 1 in 18. In addition, 7848 visits were made to taps found defective, or which had been reported at the office as being defective. 2657 notices were served in the case of defective taps, and in 121 cases the water had to be shut off to compel the repairs to be made. River Supply Works: The tenders for the pumping-engines, received on the 11th of May last, are still under the consideration of the Works Committee. Tenders for the forming of the reservoirs, and the constructing of the foundations of the engine and boiler houses, have been advertised for.

Register of New Patents.

3327.—Surmon, H. J., Belvidere, Kent, "*Improvements in apparatus for manufacturing gas.*" Provisional protection only obtained. Dated Oct. 14, 1873.

This improved apparatus is constructed as follows:—The stove or furnace wherein the retort is placed is built of brickwork, and with a solid flat bottom very close to the retort. It has a flue at the back, and a double chamber which causes the flame to travel around the retort and ascend the flue. A T-shaped retort is used, which is placed in the furnace or stove with the vertical stem or branch upwards. The inside of this vertical stem is provided with a series of bowls or chambers. Inside the retort, at the bottom of the aforesaid stem or branch is fitted a portable sliding frame, constructed of angular iron bars. The front of the retort is provided with a mouthpiece and a cover, formed with a V-shaped face. This improved apparatus is provided with a purifier, which has five chambers; four of these chambers are partly filled with lime and water, the fifth chamber is filled with small iron saturated with sal-ammoniac. The gasholder is provided with a telescopic outlet-pipe at the top.

3331.—Towle, J., Oxford, "*Improvements in the means employed for treating sewage.*" Patent dated Oct. 15, 1873.

This invention consists in filtering the liquid sewage through beds of town refuse contained in pits or receivers, having perforated floors placed over a pumping well or receptacle for the filtered sewage. The sewage is pumped from the well into a tank to be distributed where desirable by suitable hose and pipes.

3343.—Lake, W. R., Southampton Buildings, London, "*Improvements in double acting lift and force pumps.*" A communication. Provisional protection only obtained. Dated Oct. 15, 1873.

The first part of the said invention consists in arranging the air-vessel over and between the two pumps, to form the fulcrum for the lever, in combination with a water-way. The second part of the said invention is designed to prevent destruction of the pumps and great inconvenience and damage by water, resulting from inability to sufficiently empty the pump of the water to prevent the bursting of the cylinders in cold weather. The third part of my invention is designed to provide a jointed double journal box, or bearing, for the axle of the pump.

3353.—Clark, A. M., Chancery Lane, London, "*Improvements in the manufacture of artificial fuel and in the production of gas for illuminating and heating purposes.*" A communication. Patent dated Oct. 16, 1873.

This invention relates to a method of simultaneously producing gas for illuminating and heating purposes and an agglomerated fuel suitable either for domestic use or for other heating purposes, and for the production of gas by distillation.

The improvements relate—

1. To the production of gas for illuminating and heating purposes from lignite, peat, or dried wood saturated with a hydrocarburet, either with the aid of pressure or by simple immersion at given temperatures.

2. To the production of fuel from lignite, peat, or desiccated wood, possessing greater calorific power, of greater density, less hygrometric, and, therefore, more permanent, by the absorption by the pores of the lignite, peat, or desiccated wood, of tar or other liquid hydrocarburets.

3. In the production of charcoal from the lignite, peat, desiccated wood, or residue of the manufacture of gas from the lignite or peat described under the first head.

I take lignite, known as pitch, coal, or analogous substance, tan, or wood sawdust, and gas tar when it is desired to produce ordinary gas, but I modify the composition when it is desired to obtain a rich quality of gas similar to that obtained from Boghead.

The following are the approximate proportions in each case:—For ordinary quality gas—Lignite, pounded fine, 1000 lbs.; tan or wood sawdust, pounded fine, 200 lbs.; tar from rich gas, 100 lbs. For rich quality gas—Lignite (pounded), 1000 lbs.; tan (pounded), 200 lbs.; tar (disacidified) of petroleum, 100 lbs.; tar, residue of the purification of oil of cotton or other seed, 100 lbs.

These several matters are first worked up in a mixer, then moulded into cylindrical or other shaped lumps, which are then placed in an apparatus and heated for obtaining gas therefrom, and, after being extinguished and cooled, they serve as fuel for domestic purposes, or the lumps, after merely being moulded, may be supplied to existing gas-works where rich or poorer gas may be obtained from lignite and other matters hitherto deemed valueless, simultaneously with the production of a cheap fuel for household and manufacturing uses free from smell, and possessing a calorific power at least equal to wood charcoal.

3372.—Belt, A., New Cross, "*Improvements in safety gas-burners.*" Patent dated Oct. 18, 1873.

This invention consists in automatically shutting off the supply of gas to the burner or nipple when the gas is put out, accidentally or otherwise, and to effect this object a valve is placed between the gas supply and the burner, which valve is operated by heated or expanded atmospheric air or gas acting upon a metal diaphragm, which is placed immediately below the valve. The heat necessary for the expansion of the air is obtained from the lighted jet of gas at the burner acting upon a chamber of air, which chamber of air communicates with the under side of the metal diaphragm; this being raised by the expansion of the air, touches the bottom of the valve, and raises it sufficiently to allow the gas to reach the burner, the heat of which maintaining the chamber of air in a rarefied or expanded state, keeps the diaphragm up and the valve open so long as the gas is burning. Upon the light at the burner being blown or put out, accidentally or otherwise, the air in the chamber cooling resumes its normal density, and allows the diaphragm to fall, and with it the valve, thus closing the supply of gas to the burner, and preventing the liability to explosions by escape of gas from the burner.

To light or relight the gas, apply for a few seconds a lighted taper, or other equivalent, to the outside of the air-chamber, for the purpose of heating the air and raising the valve, as before described.

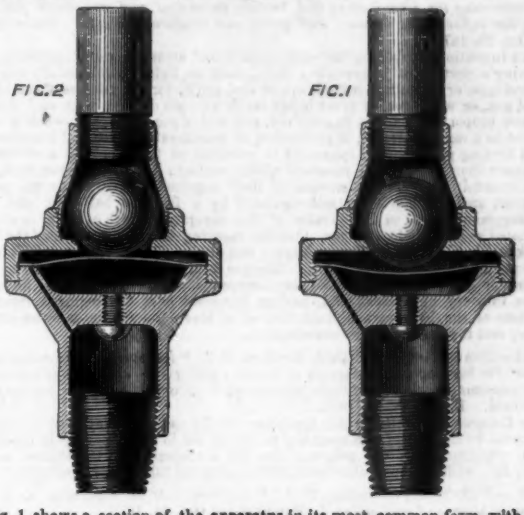


Fig. 1 shows a section of the apparatus in its most common form, with the valve down on its seat, and the supply of gas to the nipple or burner consequently shut off. The air-chamber, in the absence of any heat from the lighted gas at the nipple, or mechanically applied to the external part of the apparatus by a lighted taper or other equivalent, is of the same temperature, and consequently of the same density or pressure as the external atmosphere. The diaphragm, which is made of gold, silver, platina, copper, or any other metal or amalgam of two or more metals rolled into a thin plate, is of a "dished" form, to give it the power of rising or falling under pressure, and it is fixed by soldering or other means to the lower part of the case, the upper part of the case being screwed or otherwise fixed to the lower part, so as to make it air or gas tight. This case may be made of brass, copper, iron, or any other metal or mixture of metals. A hole is drilled from the upper side of the diaphragm, through the body of the case, to the lower part of same, through which the gas passes to the upper side of the diaphragm. One, two, three, or more of these holes or gas-passages may be made, as occasion may require. A small screw is employed for the admission of atmospheric air or gas at its normal density to the air-chamber, after the diaphragm is soldered or otherwise fixed on, this screw being "screwed" tightly into its place, so as to render the air-chamber air-tight.

Fig. 2 shows a similar section of the apparatus, at the time the gas is burning, and the air in the chamber consequently expanded by the heat conducted from the burner; the diaphragm is now up and the valve lifted by the diaphragm from its seat, allowing sufficient space for the gas to flow through the passage or passages to the nipple or burner. It will thus be seen that so long as the heat from the light is maintained the air in the chamber will be so expanded as to keep the valve open, and that when the light is blown or otherwise put out the air in the chamber cooling to the temperature of the external air allows the valve to fall and shut off the supply of gas from the burner.

3383.—Quick, J., jun., and Restler, J. W., Great George Street, Westminster, "*Improvements in apparatus for measuring the passage of water and other liquids, also for pumping purposes.*" Patent dated Oct. 18, 1873.

This invention relates to apparatus for measuring and registering the passage of water and other liquids. The apparatus consists of a circular casing in which a skeleton drum is fitted eccentrically; the drum carries, say, three plates, which are alternately pushed out under the action of a cam, or its equivalent, for their end edges to bear against the inner periphery of the outer casing, with which they are kept in contact during about one-half revolution, and are alternately pushed into the drum by the outer casing during the other half of their revolution. The plates have rollers upon their inner ends to bear against a cam, and their edges have grooves, into which strips of suitable packing are fitted to act as packing-pieces to reduce friction and to prevent escape of liquid from one pocket to the next. The drum in some cases has on each edge a fillet, or a groove, in which a fillet of suitable packing is fitted, and this bears against the flat faces of the casing to preserve the drum water-tight.

The water or other liquid enters from a nozzle or pipe attachment at one portion of a band or ring which determines the width of the apparatus, and it presses upon the face of the extended plate to force it and the drum round. The plate continues to extend until it has travelled about one-half of its distance round the casing, when the shape of the cam permits it to go into the drum again under the pressure of its edge against the casing, the plate then getting into position again for the cam to force it outwards. When the plate begins to go into the drum the pocket of liquid which was between it and the next succeeding plate is free to escape by the outlet nozzle; thus each plate being acted upon in succession maintains the rotation of the drum, and consequently the number of fillings of the pockets which are indicated upon a dial-face, the index hand of which is actuated by gearing from the axle of the rotating drum.

The apparatus is equally applicable for pumping purposes by driving the axle and the inner drum by gearing or by direct action, as desired.

In lieu of the plates being fitted with rollers, they may be connected by rings on their inner ends with a fixed circular band concentric with the outer casing, and their motion be governed by the action of the axle as it travels round the two centres with the drum, the plates of which radiate from the axle centre instead of from the drum centre and the previously described arrangement.

3430.—Wilkinson, S., Sheffield, "*An improved arrangement for relieving the pressure in gas-retorts.*" Provisional protection only obtained. Dated Oct. 22, 1874.

The object of this invention is to relieve the pressure from the retort leading into the hydraulic main, also to hermetically seal the end of the pipe that connects the retort with the said main as soon as the mouthpiece is taken off the retort. This may be effected by constructing the hydrant as follows:—Beneath the open end of the hydrant or pipe before mentioned, situated in the hydraulic main, is suspended a cup-shaped piece of metal into which water is allowed to enter from the hydraulic main, thereby sealing the end of the hydrant or pipe. The pressure from the retort acting on the surface of the water in the aforesaid

cup forces the water out of the said cup, thereby unsealing or uncovering the open end of the said hydrant or pipe, and thus relieves the pressure from the retort; this done, the cup immediately becomes filled again with water, so as to again seal the end of the hydrant or pipe, and so on each time that the mouth is taken off the retort, the operations of sealing and unsealing the hydrant or pipe being self-acting.

3441.—SEDGERS, L., Berners Street, London, "*Improvements in the construction and arrangement of apparatus for economizing the consumption and increasing the illuminating and heating powers of coal gas, water gas, and other inflammable vapours and gases, and mixtures thereof.*" Patent dated Oct. 23, 1873.

This invention consists in the construction and arrangement of apparatus containing a portion of hydrocarbon fluid, such as light petroleum oil, spirit of petroleum, or benzoline, or shale oil, or coal spirit, for the purpose of combining coal gas, or water gas, or other inflammable vapours or gases with such fluid in proper proportions as may be required, and which gas or vapour, when so combined in a regular service, is productive of considerable additional illuminating and heating power. The apparatus is provided at the top, or at a convenient distance therefrom, with a reservoir which contains the hydrocarbon fluid, and continuously supplies the amount of fluid required for enriching the gas or vapour, such supply being self-regulated by a float or ball-cock and ball arrangement placed in the cylinder of the apparatus, which cylinder is so constructed as to exclude the gas, thereby ensuring the free working of the ball-cock and ball. Such continuous supply can also be effected automatically upon the pneumatic fountain principle. The gas from an ordinary gasometer or gas-meter, or gases or vapours from any source, is or are conveyed by an inlet-tube into the apparatus; and, having traversed over the required extent of surface of the hydrocarbon fluid, leaves or leave the apparatus by an outlet-tube, and is or are ready for consumption.

3445.—ROBERTSON, J., Nitshill, Renfrew, N.B, "*Improvements in compressing air for burning in combination or mixture with gas or inflammable vapour in apparatus for finishing textile fabrics, &c.*" Provisional protection only obtained. Dated Oct. 23, 1873.

The features of novelty in this invention are the use or employment of bellows, actuated by the feet of the operator, to supply air to the reservoirs in combination or mixture with the gas, and also the combination of the bellows, reservoir, &c., with the apparatus used for finishing the fabrics operated upon.

3457.—WEEMS, W., Johnstone, N.B., "*Improvements in apparatus or means for lighting and ventilating.*" Patent dated Oct. 24, 1873.

This invention relates to the employment of reflecting surfaces for intensifying or increasing the lighting power of gas and other lights, and a means of carrying away the smoke and products of combustion and other vapours.

3459.—SMITH, T. J., Fleet Street, London, "*Improved means of and appliances for facilitating the lighting of gas-jets.*" A communication. Provisional protection only obtained. Dated Oct. 24, 1873.

A pressure of air is caused to actuate a diaphragm and a link to open and to close the gas-cock. A small burner enclosed in a case is put into communication with the gas supply when the usual burner is being shut off to take a supply, and for that to be lighted.

APPLICATIONS FOR LETTERS PATENT.

2461.—SPENCE, W., Chancery Lane, London, "Improvements in the treatment of liquid sewage in order to fix the azote and phosphate substances contained therein and convert them into solid matter." A communication. July 14, 1874.

2481.—FEARNS, F. H., and JACKSON, W., Marlborough Road, Surrey, "Improvements in stoves for cooking and heating by gas, and in apparatus connected therewith." July 16, 1874.

2493.—HACHE, E. H., Paris, "An improved mechanical apparatus for indicating by clockwork the excessive pressures of lighting gas." July 16, 1874.

2495.—NEWTON, W. E., Chancery Lane, London, "Improvements in the manufacture of inflammable gas for illuminating and other purposes, and in the apparatus to be used therein." A communication. July 16, 1874.

2496.—WISE, W. L., Adelphi, London, "Improvements in apparatus for purifying and filtering water." A communication. July 16, 1874.

2499.—FINCH, B., High Holborn, London, "Improvements in self-regulating supply-valves for tanks." July 16, 1874.

2506.—CHIVERTON, E., Southsea, Hants, "Improved means of and apparatus for lighting gas-lamps or burners." July 17, 1874.

2520.—JOHNSON, J. H., Lincoln's Inn Fields, London, "Improvements in the separation of ammonia from illuminating and other gases." A communication. July 18, 1874.

2526.—STRATEN, E. VAN DER, Antwerp, "Improvements in apparatus for the combustion of air and gas for heating purposes." July 18, 1874.

2546.—PERCH, W., and HIGGS, P., Cardiff, "Improvements in the pistons of steam, air, gas, or vapour engines, whereby increased surface is obtained." July 21, 1874.

2554.—HARRINGTON, J., and BRENT, H., Ryde, "Improvements in gaseliers." July 21, 1874.

2563.—CLARK, A. M., Chancery Lane, London, "Improvements in steam-pumps." A communication. July 22, 1874.

2566.—MOULY, F. V., Leicester Square, London, "Improvements in apparatus for heating and ventilating dwelling-houses and other buildings." July 22, 1874.

2567.—WILLETT, G., HARRIS, R. J., and LUND, J., Worthing, "An improved sewage-filter." July 22, 1874.

2569.—NEWTON, W. E., Chancery Lane, London, "Improvements in gas-burners." A communication. July 22, 1874.

2571.—CLARK, F. W., Hackney, "Improved apparatus for generating carburetted hydrogen gas." July 22, 1874.

2572.—FORBES, G. H., Broughton Rectory, Northampton, "Improvements in the manufacture of gas for illuminating and heating purposes." July 22, 1874.

2583.—BALL, A., Spalding, "Improvements in the construction, heating, and ventilating houses and other buildings." July 23, 1874.

GRANTS OF PROVISIONAL PROTECTION.

2315.—BENTLEY, J., Birmingham, "An improved sanitary apparatus or pump for raising and delivering sewage or other diluted refuse matter, but which said apparatus is also applicable for elevating and delivering water or other fluids." July 3, 1874.

2318.—KUNSTADTER, J. J., Camomile Street, London, "Improvements of apparatus for causing the flow of liquids, and also in apparatus to obtain motive power from the flow of liquids." July 3, 1874.

2328.—COLLS, F. W., Erith, Kent, "Improvements in safety-valves." July 3, 1874.

2330.—COLLS, F. W., Erith, Kent, "Improvements in traps for preventing the escape of gases from sewers and drain-pipes." July 3, 1874.

2338.—WELLS, J., Wednesbury, "Certain improvements in main-cocks for gas and water purposes, but which said improvements are also applicable for main-cocks for the controlling of fluids." July 4, 1874.

2371.—WALKER, W., Newton Moor, Chester, "Improvements in direct-acting steam pumping-engines." July 7, 1874.

2374.—FORBES, Rev. G. H., Broughton, Northampton, "Improvements in the manufacture of cements." July 7, 1874.

2397.—WILSON, H., Stockton-on-Tees, and STEEL, J., Glasgow, "Improvements in apparatus for cooling and heating liquids and gases." July 8, 1874.

2404.—COOPER, H. E., Bethnal Green Road, London, "Improvements in the means of and in apparatus for carburetting air or gas for illuminating or heating purposes." July 8, 1874.

2428.—MACKENZIE, T., Wednesbury, "Improvements in steam pumping and blowing machinery." July 10, 1874.

2431.—WHITTON, C., Leslie, N.B., "Improvements in stop-valves for steam and other pipes." July 11, 1874.

2434.—WARREN, S. H., Crewe, and WATES, P. J., Greenwich, "Improvements in machinery and apparatus for charging and drawing retorts." July 11, 1874.

2439.—SCHMERSAHL, A. E., Manchester, "Improvements in treating sewage water and other foul liquids for the purpose of purification, and in the manufacture of manure." July 11, 1874.

2446.—LYTTLE, W. A., Hammersmith, Middlesex, "An improved process for treating sewage, and for utilizing certain products derived therefrom." July 13, 1874.

2450.—SCOTT, H. Y. D., Ealing, Middlesex, "Improvements in the recovery of carbonate of ammonia from sewage." July 13, 1874.

2468.—WARBURTON, S., Pendleton, "An improved apparatus for the purpose of singeing off the loose fibres of yarns by means of atmospheric gas." July 15, 1874.

NOTICES TO PROCEED.

840.—COOK, H. W., Brompton, Middlesex, "Improved apparatus for pumping or forcing water, air, gas, or other liquids or fluids." March 7, 1874.

874.—TANDY, G. G., Penge, Surrey, "Improvements applicable to street and signal lamps." March 10, 1874.

1157.—BIRCH, R. W. P., Victoria Street, Westminster, "Improvements in apparatus for flushing sewers, drains, reservoirs, and other waterways, applicable also for discharging measured quantities of water or other fluid." April 2, 1874.

2274.—CONNELL, W., Glasgow, "Improvements in valves for water-supplying apparatus." July 1, 1874.

2318.—KUNSTADTER, J. J., Camomile Street, London, "Improvements of apparatus for causing the flow of liquids, and also in apparatus to obtain motive power from the flow of liquids." July 3, 1874.

PATENTS WHICH HAVE PASSED THE GREAT SEAL.

251.—ABRAHAMS, A., St. Peter's Park, Middlesex, "Improvements applicable to gas-lamps." Jan. 20, 1874.

322.—CLARK, A. M., Chancery Lane, London, "An improved process for eliminating the soluble principles contained in gases and vapours." A communication. Jan. 24, 1874.

342.—LAKE, W. R., Southampton Buildings, London, "An improved apparatus for maintaining a constant level of water in wet gas-meters, and for separating from vapour liquid held in suspension in the same." A communication. Jan. 27, 1874.

347.—TANDY, G. G., Penge, and DRYDEN, J. A., Battersea, "Improvements in lamps." Jan. 27, 1874.

348.—WHITTINGHAM, J., London, "Improved apparatus for manufacturing gas for illumination." A communication. Jan. 27, 1874.

485.—HARROP, J. J., Manchester, "Improvements in the manufacture of tin-lined lead piping, and of tin and lead piping, and of soil and water pipes, and in the apparatus employed in such manufacture, and in the covering of telegraph cables with lead." Feb. 6, 1874.

486.—FORD, S., South Lambeth, "Improvements in prime movers actuated by the explosive force of mixtures of gases." Feb. 6, 1874.

531.—JOHNSTON, W., Lima, Peru, "Improvements in machinery or apparatus for compressing air or gases." Feb. 11, 1874.

720.—WOODCOCK, J., Plymouth, "Improvements in valves for regulating the supply of water to cisterns or tanks." Feb. 25, 1874.

919.—NEWTON, A. V., Chancery Lane, London, "Improvements in the construction and setting of retorts, and in processes of operating retorts for the manufacture of illuminating gas." A communication. March 13, 1874.

991.—HOWARD, J., Camberwell, Surrey, "A new self-acting apparatus for regulating the supply of water, and disinfectant for flushing and disinfecting water-closets." March 21, 1874.

1211.—THOMAS, C. W. W., Buckhurst Hill, Essex, "Improvements in apparatus for manufacturing heating and illuminating gas." April 7, 1874.

1279.—PORRI, J., and LEIGH, E., Blackrod, near Chorley, Lancs, "Improvements in apparatus used in the manufacture of gas." April 14, 1874.

1332.—JOHNSTON, W., Lima, Peru, "Improvements in machinery or apparatus for compressing air or gases, or for forcing water." April 17, 1874.

1619.—FROST, H., Manchester, "Improvements in fluid-meters, applicable also to apparatus for obtaining motive power and for pumps." May 7, 1874.

1698.—WARNER, W. J., South Shields, and COWAN, W., Edinburgh, "Improvements in gas-meters." May 13, 1874.

1715.—HYATT, T., London, "Improvements in constructing, lighting, ventilating, and fire-proofing buildings, partly applicable to building materials and appliances and to ships." May 14, 1874.

1799.—ALEXANDER, E. P., Southampton Buildings, London, "Improvements in liquid-meters." A communication. May 21, 1874.

PATENTS WHICH HAVE BECOME VOID

BY REASON OF THE NON-PAYMENT OF THE ADDITIONAL STAMP DUTY OF £50 BEFORE THE EXPIRATION OF THE THIRD YEAR.

1576.—EVANS, J., and EVANS, W., "Improvements in pumping machinery." June 14, 1871.

1641.—HUGHES, E. T., "An improved valve for stopping and regulating the supply of water, gas, air, and other similar purposes." June 22, 1871.

1695.—PINDER, M., "Improvements in joints for pipes." June 29, 1871.

1713.—LAKE, W. R., "Improvements in mechanism for operating the valves of water-meters." July 1, 1871.

1716.—DAVIES, P. J., "An improved apparatus for the prevention of damage caused by the bursting of water-pipes in times of frost or otherwise, and for the prevention of water waste generally." July 3, 1871.

1804.—HOLLINSHEAD, W., "Improvements in the method of and apparatus for lighting railway carriages with gas." July 11, 1871.

1845.—PRESTON, F. P., PRESTIGE, J. T., PRESTON, E. J., and PRESTIGE, W. A., "Improvements in waste-water preventer taps, so that they shall act without the use of plug-cocks." July 14, 1871.

1847.—TARGET, F. N., "Improvements in dry closets and commodes." July 14, 1871.

Notes and Queries.

Weight of Ammoniacal Liquor (answer to E. S. C).—The weight of liquor may be calculated from data given in Newbigging's "Handbook," pp. 26, 154, and 282. Six-ounce liquor will be 3° Twaddel, and the specific gravity will consequently be 1015, which number in ounces will be the weight of a cubic foot of the liquor. A cubic foot being 6¼ gallons, the weight of a gallon is easily calculated. The rule will be—convert degrees of Twaddel into specific gravity, divide by 16 for the number of pounds in the cubic foot, and then by 6·25 for the weight of a gallon of the liquor. A.

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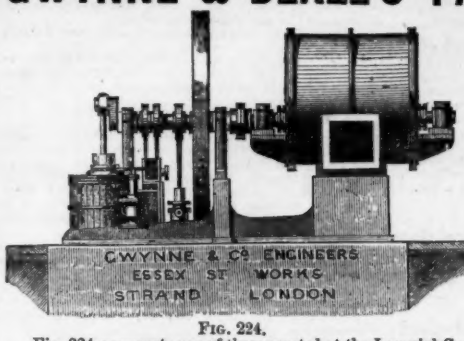

FIG. 224.

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By order,
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Lurgan Gas-Works, July 6, 1874.

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TWO Oblong Purifiers, 6 ft. by 4 ft., and 3 ft. 6 in. deep, cast-iron covers, excellent lifting gear, hydraulic change-valve, wood grids, with all the 6-in. connexions complete.

The above are in first-rate condition, very neat and compact, admirably suited for a small works, and only removed in order to make room for a larger set.

For further particulars apply to R. M. TURNER, Manager, Enniskillen Gas-Works, Ireland, or Mr. MALAM, Gas-Works, HALIFAX.

TO GAS MAKERS.

THE Bishop's Castle Gaslight and Coke Company, Limited, are prepared to receive TENDERS from GAS MAKERS, who must be competent to make gas, attend to the fittings, and devote the whole time to the service of the Company. He will be provided with a house, rent free, coals, and light.

Tenders to be sent in, with testimonials, to the Secretary, on or before the 1st of August next, stating salary. Population under 2000.

THOS. GRIFFITHS, Secretary to the Company.
Bishop's Castle, July 17, 1874.

TO PIPE LAYERS AND OTHERS.

THE Aberdare and Aberaman Consumers Gas Company, are prepared to receive TENDERS for taking up and relaying several miles of MAIN-PIPES, 8 in. to 2 in. diameter, and also for laying new pipes.

The specification may be seen, and forms of tender obtained, on application to me at the Office of the Company in Aberdare, or to the Engineer, Mr. G. W. Stevenson, 19, Great George Street, Westminster, and tenders must be delivered to me on or before the 31st of July inst.

The Directors do not bind themselves to accept the lowest or any tender. By order,

EVAN JONES, Manager and Secretary.
Aberdare, July 20, 1874.

GAS TAR AND AMMONIA WATER.

THE Chorley Commissioners invite TENDERS for the GAS TAR and AMMONIA WATER made at the Chorley Gas-Works, for One, Two, or Three years, which will be delivered at the works.

Further particulars may be obtained on application to Mr. Thomas Hamer, Manager.

Tenders, endorsed "Tender for Gas Tar, &c.," will be received by the undersigned up to Saturday, Aug. 1.

The Commissioners will not be bound to accept the highest or any tender. By order,

RICHARD JACKSON, Solicitor,
Clerk to the Chorley Commissioners.
Chorley, June 26, 1874.

NEWPORT (MON.) GAS COMPANY.

TO CONTRACTORS AND BRICKLAYERS.

THE Directors of the above Company are prepared to receive TENDERS for the construction of a brick GASHOLDER-TANK, at their Gas-Works, Newport, Monmouthshire.

The Tank is to be 100 ft. in diameter, and 25 ft. 6 in. deep, inside measure, when completed.

Plans and specifications may be seen upon application to Mr. Henry Bowen, Engineer, Cardiff, or to the Manager, at the Company's Offices, Newport.

Sealed tenders, addressed to the CHAIRMAN of the Directors, and endorsed "Tender for Brick Tank," to be sent in on or before the 8th of August next.

The Directors do not bind themselves to accept the lowest or any tender.

Gas-Works, Newport, Mon., July 13, 1874.

IN CHANCERY.

IN THE MATTER OF THE COMPANIES ACTS, 1862 AND 1867, AND

IN THE MATTER OF THE PATENT GAS COMPANY, LIMITED.

THE Creditors of the above-named Company are required, on or before the 15th day of September, 1874, to send their NAMES and ADDRESSES and the particulars of their DEBTS or CLAIMS, and the names of their Solicitors, if any, to François Mackenzie, Joseph Weatherley, and Augustus Albert Smith, the Liquidators of the said Company, at the Office of the Company, 25, Fenchurch Street, in the City of London, and if so required by notice in writing by the said Liquidators, or by their Solicitors, to come in and prove their debts or claims at the Chambers of the Vice-Chancellor Sir Richard Malins, No. 3, Stone Buildings, Lincoln's Inn, in the county of Middlesex, at such time as shall be specified in such notice, or in default thereof they will be excluded from the benefit of any distribution made before such debts are proved. Monday, the 2nd day of November, 1874, at Twelve o'clock, is appointed for hearing and adjudicating upon the debts and claims.

Dated this 22nd day of July, 1874.

FREDERICK HERITAGE, Solicitor for the Liquidators.
28, Nicholas Lane, E.C.

FERNDALE GASLIGHT AND COKE AND WATER-WORKS COMPANY, LIMITED.

TO BUILDERS, GAS APPARATUS MAKERS, PIPE-FOUNDERS, AND OTHERS.

THE above Company solicit TENDERS for work to be done in the ERECTION of GAS-WORKS at Ferndale, near Pontypridd.

Contract No. 1.—The excavation, masonry, &c., for a cast-iron Gasholder-Tank, the building of Boundary Walls, and the erection of all buildings requisite in the construction of such Gas-Works.

Contract No. 2.—The taking down, removal from Aberdare, and re-erection at Ferndale of a Cast-Iron Tank, Gasholder, &c., and the supplying and erection of all additional and requisite new Apparatus.

Contract No. 3.—Laying about 4000 yards of Street Mains.

Contract No. 4.—The making and delivery of about 4000 yards of Cast-Iron Common Socket and Spigot Main-Pipes, with all irregular castings necessary in laying the same.

Full particulars may be obtained, and inspection of the plans and specifications, on application to Mr. JOHN LEES COCKER, Gas-Works, Merthyr Tydfil.

Sealed tenders, to be forwarded to the undersigned, endorsed with the No. of the Contract, on or before the 8th of August next.

The Directors do not undertake to accept the lowest or any tender. By order,

J. EDWARDS PRICE, Secretary.
The Court House, Pontypridd.

THE AUTOGEN PURE GAS COMPANY, LIMITED.

CAPITAL £24,000, in Shares of £1 each.

Temporary Offices:
17, QUEEN VICTORIA STREET, MANSION HOUSE, LONDON, E.C.

This Company is prepared to enter into CONTRACTS for the supply of their SELF-ACTING APPARATUS, varying in size from 12 inches upwards, for the manufacture of gas for lighting and heating private houses, churches, manufactories, railways, ships, &c., and they invite the public to inspect the process exhibiting the purity, quality, &c., any day, between the hours of Two and Six p.m., on production of their cards.

Every information as to prices, contracts, &c., as well as prospectuses, reports, and forms of application for shares, may be obtained as above. By order.

TO GAS COMPANIES.

A Quantity of Bright Derbyshire Gas COAL, of excellent quality, having been carefully tested in practical working, FOR SALE.

For quotations, address Mr. W. A. PLUMBE, MANSFIELD.

CANNEL.

THE West Yorkshire Iron and Coal Company, Limited, will be glad to receive FORMS for TENDERS from Gas Companies and others requiring a supply of CANNEL.

Address, 72, Wellington Street, LEEDS.

TO COLLIERY OWNERS, &c.

THE Directors of the Barnsley Gas Company hereby invite TENDERS from parties willing to contract to supply and deliver at their works, situated at Old Mill and Pontefract Road, Barnsley, respectively, RIDDLED SLACK, or NUTS, and SOFT COAL of the best quality, for Gas Making, that they may require for a period of One, Two, or Three years (as may be agreed upon), from the 1st day of October, 1874; the said Nuts or Coal to be delivered in a dry condition, free from smudge, dirt, shale, pyrites, or other impurities, at either of the said works, in such quantities and at such times as the Manager may direct. There are railway sidings into both works, or, if more convenient to the parties tendering, they may deliver the said Nuts or Coal by cart at either of the said works, which latter method the Directors would prefer.

Prices may be quoted either by cart or rails, and sealed tenders, stating respectively the price for Nuts or Coal delivered as above, endorsed "Tenders for Coal," and addressed to the Chairman, must be left at the Gas Company's Office on or before Thursday, the 13th day of August next.

Any further information required may be obtained on application to the Manager, at the Works.

The Directors do not bind themselves to accept the lowest or any tender. (By order)

Gas Offices, Pontefract Road, JOHN HUTCHINSON,
Barnsley, July 24, 1874. Manager.

TENDERS FOR COALS.

SPECIFICATION.

THE Derby Gaslight and Coke Company are prepared to receive TENDERS for the supply of 28,000 tons of SOFT COALS and SOFT COBBLES or NUTS, to be divided into four contracts, of 7000 tons each; and to be delivered in the following monthly quantities, viz.:—

1874	August	400
	September	800
	October	900
	November	1000
	December	1000
1875	January	800
	February	600
	March	400
	April	300
	May	300
	June	300
	July	200
	Total of each contract	7000

The Company will undertake to receive from the party or parties contracting the total quantity of 28,000 tons, in one, two, three, or four contracts, as the Board may decide; but they do not bind themselves to accept the lowest or other tender or tenders, until after a satisfactory trial of the Coals and Cobbles or Nuts to which such tender or tenders may relate shall have been made. They are to be the best of their kind, and as free as possible from sulphur, bats, bind, refuse, and dirt, and shall be weighed upon a correctly adjusted machine.

Payments will be made monthly, if and so long as the contracts shall be duly fulfilled, to the extent of nine-tenths of the amount of the invoices, and the balance will be discharged on the satisfactory completion of the contract.

Sealed tenders (to be made on forms obtainable at the Company's Office), specifying the description of Coals and the pits at which they are to be raised, and stating the prices for delivery by canal at Derby at the new Gas-Works, adjoining the Midland Railway Company's workshops, or at the canal wharf, and also the price delivered at either of the Midland Railway Stations, Derby, and in manner and subject to the conditions aforesaid, must be delivered at the Offices of the Company, Friar Gate, on or before Saturday, the 1st day of August next.

The respective contracting parties will be required to execute an agreement to be prepared by, and to the satisfaction of, the Secretary of the Company.

By order of the Directors,
ISAAC FISHER, Secretary.
Derby Gas Office, July 15, 1874.

PIPES.—A large stock of 3-in., 4-in., 6-in., and 8-in. Cast-Iron SOCKET and SPIGOT PIPES (usual weights) ready for immediate delivery, either f.o.b. or ex ship or steamer in the Thames.

Address the MANAGER, Milton Iron-Works, WEST HARTLEPOOL.

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Manufactory for every description of Casting and Machinery for Gas-Works and Water-Works.

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Mr. ALFRED LASS,
60, CORNHILL, LONDON, E.C.,

Is prepared to open the Books, and, if necessary, keep the Accounts of Gas and Water Companies.

To examine the Books and Accounts, and prepare Balance-Sheets for the information of Directors.

To assist Secretaries in preparing Balance-Sheets, according to the "Gas-Works Clauses Act, 1871;" or may be consulted with respect to Accounts generally.

TO INVENTORS AND PATENTEES.

MR. W. H. BENNETT, having had considerable experience in matters connected with Gas, Water, and Sanitary Improvement, begs to say that he continues to assist Inventors in the perfection of their designs, and to obtain for them PROVISIONAL PROTECTION, whereby their invention may be secured for Six Months; or LETTERS PATENT, which are granted for Fourteen Years.

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BY THOMAS NEWBIGGING, A.I.C.E.

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South Shields. W. J. WARNER.

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BRONNER'S PATENT GAS-BURNERS give 99 per cent. of light, as compared with 27 per cent. given by ordinary burners, with equal consumption of gas.—*Vide* "Gas Referees Report," published June, 1869.

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Apply to CHARLES FORSTER COTTERILL, Finney House, Cannock, STAFFORD, Patentee.

OXIDE OF IRON.—
We are prepared to supply, on moderate terms,
HYDRATED PEROXIDE OF IRON (BOG OCHRE),
Same quality as supplied by us to several of the most extensive Gas Companies, and which has given entire satisfaction.

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BELFAST.

PATENT FUEL AND LIME FOR PURIFYING FROM FOUL LIME.

By a simple process the Foul Lime is converted into Fuel, by the combustion of which the lime is reproduced as a purifying agent.

Licences to work the invention will be granted to Gas Companies on very reasonable terms.

For further particulars apply to Mr. E. MADDOCKS, Manager of the Gas-Works, KETTERING.

The adoption of the above invention, without a licence from the Patentee, will be an infringement of the patent, and will subject the person or company guilty of such infringement to legal process.

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Beg to inform Gas and Water Companies and the public, that they keep in stock in London all the CASTINGS in general use in Gas and Water Works, including Iron Retorts, Socket and Flange Pipes, Bends, Branches, and Syphons of all sizes, Lamp Columns, &c., &c.

N.B.—Orders for Cast-Iron Tanks, Girders, Columns, Cylinders, and all Irregular castings, will have immediate attention. CHARLES HORSLEY, Agent.

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STATION-METERS, GOVERNORS, PRESSURE-REGISTERS,

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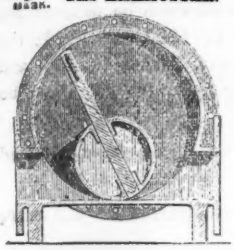
J. BEALE'S PATENT GAS EXHAUSTER.



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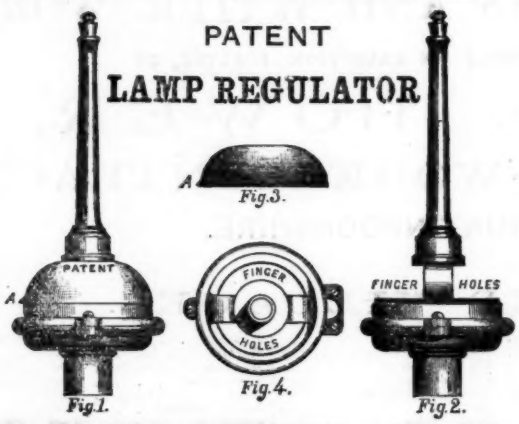

Fig.3. *Fig.4.* *Fig.1.* *Fig.2.*

D. BRUCE PEEBLES AND CO.,

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PATENTEES OF

GAS REGULATORS FOR PUBLIC LAMPS, FACTORIES, PUBLIC HALLS, AND DWELLING-HOUSES.

Attention is respectfully requested to the following extract from a lecture "On the Economical Combustion of Coal Gas," delivered to the Philosophical Society of Glasgow, by Dr. W. Wallace, F.R.S.E., F.C.S., Gas Examiner for the city of Glasgow, on the 4th of March last:—

"A few years ago, a simple form of Gas Regulator for Street Lamps was introduced, I do not know by whom, and various forms of it, and improvements on it, have been made by many practical gas engineers. Of all the modifications of the instrument, the best in my opinion is that of Mr. D. Bruce Peebles, of Edinburgh; in fact, his Lamp Regulators are so superior that they are likely to supplant all others. Already about 9000 of these have been applied to the street-lamps in Glasgow, and I understand it is the intention of the authorities to introduce them all over the town. The saving thereby effected I calculate to be about £6000 per annum, without any diminution of light. One of the great advantages of Mr. Peebles's apparatus over all others is that it can be regulated while the gas is burning."

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THOMAS ALLAN & SONS, of Springbank Iron-Works, Glasgow, manufacture small cast-iron GAS AND WATER PIPES, 1½ to 6 inches, at their branch works, Stockton-on-Tees, and have at present a large stock, which they are open to sell at moderate prices

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As supplied to the Imperial, Chartered, and other London and Provincial Gas Companies. Bellows and Valves for inflating Well Dresses, Stokers Gloves, India-Rubber Suction and Delivery Hose, Gas-Tubing, Leather India-Rubber and Gutta-Percha Machine-Bands, Sheet and Washers and Steam Joints.

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GAS & WATER-WORK ENGINEER & CONTRACTOR,

ST. NEOTS,

HUNTINGDONSHIRE.

The selected list of Gas and Water Works herewith given, is exclusive of a great number either erected complete, or the plant supplied to Agents and Engineers, the destinations of which it would not be proper to give, and of minor alterations and additions to existing works.

It will be observed that the list includes works supplied for the largest city as well as the smallest village, and to the British, the French, the Japanese, and the Italian Governments, the Shah of Persia, H.H. the Viceroy of Egypt, and a vast number of other persons of distinction. Gas-works have been sent to all quarters of the globe, and for making Gas from almost every material which will burn with a flame in open air; coal, lignite, wood, peat, bones, resins, the refuse of the olive presses, and the carcases of animals, are among the solids which have been used in one locality or another. Resin-oil, tallow, petroleum, paraffin oil, refuse of the oil distilleries, and other oils, are among the fats and liquids which have been used.

For the Indian Government, a complete plant from the retorts to the burners has been supplied, for making gas for many thousands of lights from crude mineral oil of the country.

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Mr. Bower desires to draw attention to many parts of gas apparatus which have originated with him, and which he believes not to be without merit; the following are some of them:—The Combined Purifying Apparatus, patented in 1852 and 1863; the Rising Plug-Valve, with special adaptation for working any number of Purifiers; By-pass and Four-way Valves, Engines and Exhausters on one bed-plate, Street Lanterns without bars at the side to intercept the light, and many other apparatus which may be found in his "Gas Engineer's Book of Reference."

For small Gas Apparatus, specially designed for private consumers, either Mr. Bower or his Licensees or Agents have obtained a large number of medals at the various exhibitions in this and other countries.

As an engineer, Mr. Bower will design and carry out Gas or Water Works on Commission; or, as a Contractor, he will carry them out at a lump sum, inclusive or exclusive of buildings.

A SELECTION OF GAS AND WATER WORKS

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ENGINEER & GAS-WORK CONTRACTOR,

ST. NEOTS, HUNTINGDONSHIRE.

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Ampthill	Bedfordshire
Barkway	Hertfordshire
Barrow	Lincolnshire
Beaufort	Breconshire
Belgrano	Argentine Confederation
Billingborough	Lincolnshire
Bishop's Castle	Shropshire
Bolsover	Derbyshire
Bourne	Lincolnshire
Buckfastleigh	Devonshire
Buenos Ayres	Two Works, one for the Argentine Gas Co., the other for the Mutual Consumers Gas Co.
Burford	Oxfordshire
Caerleon	Monmouthshire
Caistor	Lincolnshire
Casale	Italy
Charing	Kent
Chertsey	Surrey
Childwall	Lancashire
Chimay	Belgium
Cleethorpes	Lincolnshire
Christchurch	New Zealand
Coalville	Leicestershire
Collingham	Nottinghamshire
Colombo	Ceylon
Cottingham	Yorkshire
Crickhowel	Breconshire
Dokkum	The Netherlands
Donnington	Lincolnshire
Dragten	The Netherlands
Easton	Northamptonshire
Ebbw Vale	Monmouthshire
Eu	France
Evesham	Worcestershire
Folkingham	Lincolnshire
Gefle	Sweden
Harlingen	The Netherlands
Hatfield	Hertfordshire
Haverhill	Suffolk
Higham Ferrers	Northamptonshire
Hirwain	Glamorganshire
Horbling	Lincolnshire
Irthlingborough	Northamptonshire
Kelvedon	Essex
Kempstone	Bedfordshire
Ketton	Rutland
Kimbolton	Huntingdonshire
King's Cliffe	Northamptonshire
Kirton-in-Lindsey	Lincolnshire
Llandilo-vawr	Carmarthenshire
Llantrissant	Glamorganshire
Littlehampton	Sussex
Littleport	Cambridgeshire
Looe	Cornwall
March (*remodelled*)	Cambridgeshire
Middleham	Yorkshire
Milverton	Somerset
Minehead	Somerset
Mountsorrell	Leicestershire
Navenby	Lincolnshire
Nayland	Suffolk
Nettlebed	Oxfordshire
Newport	Essex
Oakham	Rutland
Olinda	Brazil
Pangbourne	Berkshire
Patrington	Yorkshire
Pelotas	Brazil
Porto Alegre	Brazil
Ponce	Porto Rico
Port Elisabeth	Natal
Potton	Bedfordshire
Purmerende	The Netherlands
Quorndon	Leicestershire
Raunds	Northampstonshire
Redbourne	Hertfordshire
Red Hill	Surrey
Repton	Derbyshire
Rhyader	Radnorshire
Rio Grande do Sul	Brazil
Risca and Pontymister	Monmouthshire
Rockingham	Northamptonshire
Roux	Belgium
Saffron Walden	Essex
Sandy	Bedfordshire
San Sebastian	Spain
Schagen	Holland
Shanklin	Isle of Wight
Skibbereen	Ireland
Somerby	Leicestershire
Spa	Belgium
St. Blazey	Cornwall
St. Ives	Hunts (*remodelled*)
St. Ives	Cornwall (*remodelled*)
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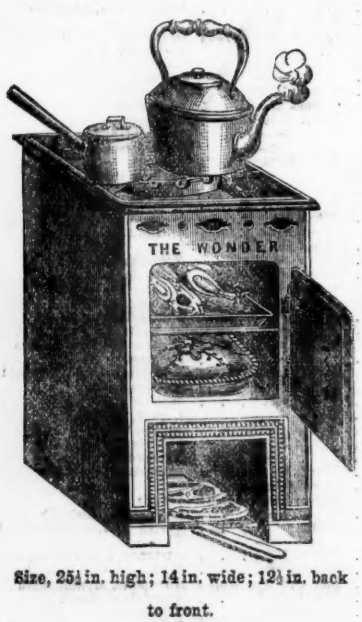

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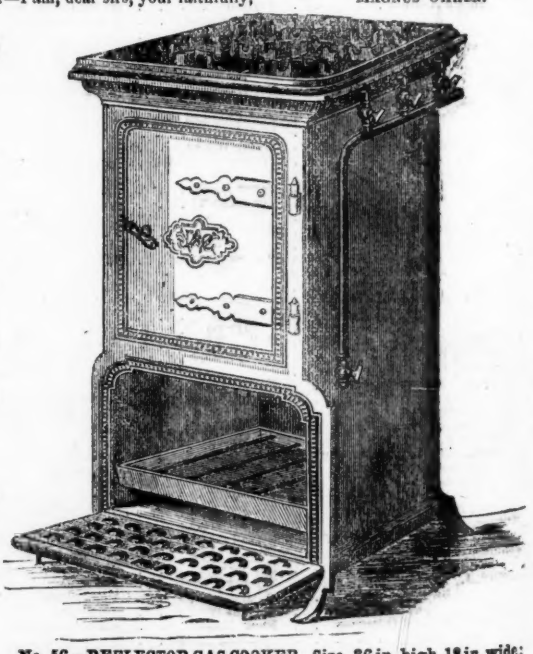
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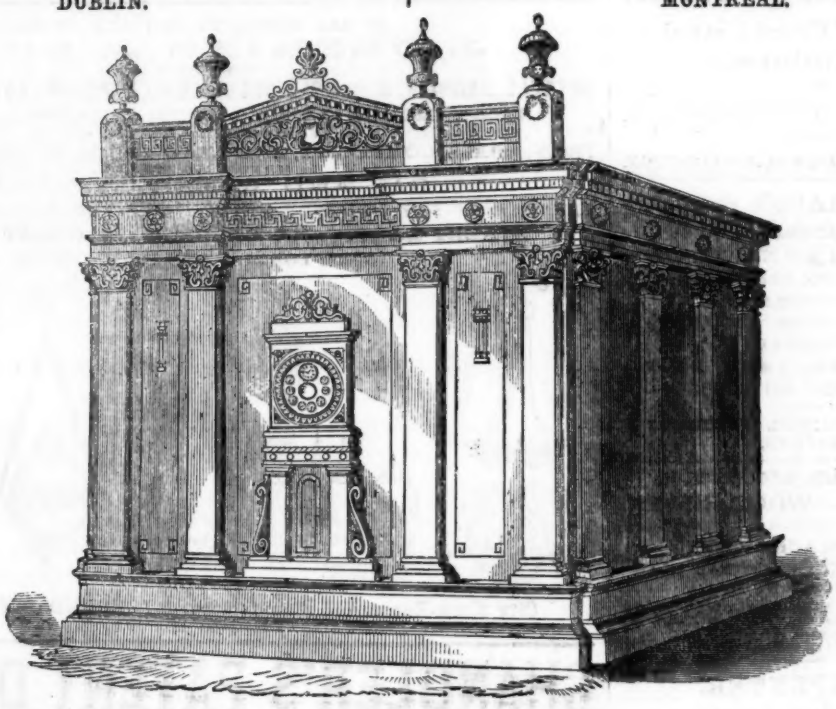

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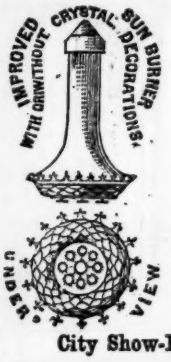

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Cut and Engraved, of the newest designs;
GAS REFLECTORS
In Silver and Glass;
GAS NIBS
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BURNERS
Of every description.
Pattern-Books of Gas-Fittings, Crystal and Ormolu Chandeliers for 1873, are now complete.

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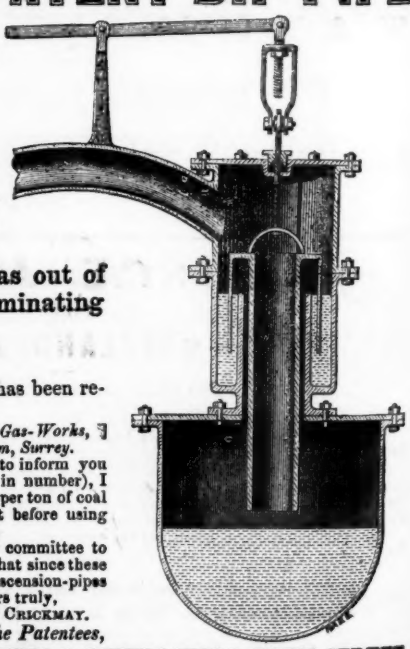
CHANDLER'S PATENT DIP-PIPE



The advantages are—
1st, There is no pressure on the Retorts.
2nd, No deposit of Carbon.
3rd, No scurfing required.
4th, Never a choked Ascension Pipe.
5th, Saves Fuel and Wear and Tear.
6th, Gets 10 per cent. more Gas out of the Coal, and a higher Illuminating Power.
7th, Is never out of order.

The following (among other letters) has been received:—

Engineer's Office, Metropolitan District Asylum Gas-Works,
Messrs. Chandler and Sons. *Caterham, Surrey.*

Dear Sirs,—In reply to your inquiries, I beg to inform you that since I have used your Patented Dips (ten in number), I find my make has increased over 1000 cubic feet per ton of coal carbonized, my usual make being 9070 cubic feet before using your Dips, and 10,150 cubic feet since using them.

I should add that I intend recommending the committee to adopt them throughout these works. I also find that since these Dip-Pipes have been fitted, I have had no ascension-pipes choked, which was before a great nuisance.—Yours truly,

Jan. 15, 1874. WM. CRICKMAY.

For terms of use and cost, apply only to the Patentees,
Messrs. CHANDLER & SONS, ENGINEERS & CONTRACTORS, YORK STREET, LONDON ROAD, SOUTHWARK, LONDON, S.E.

J. & J. BRADDOCK,

GAS ENGINEERS,

GLOBE METER-WORKS, OLDHAM,

MANUFACTURERS OF

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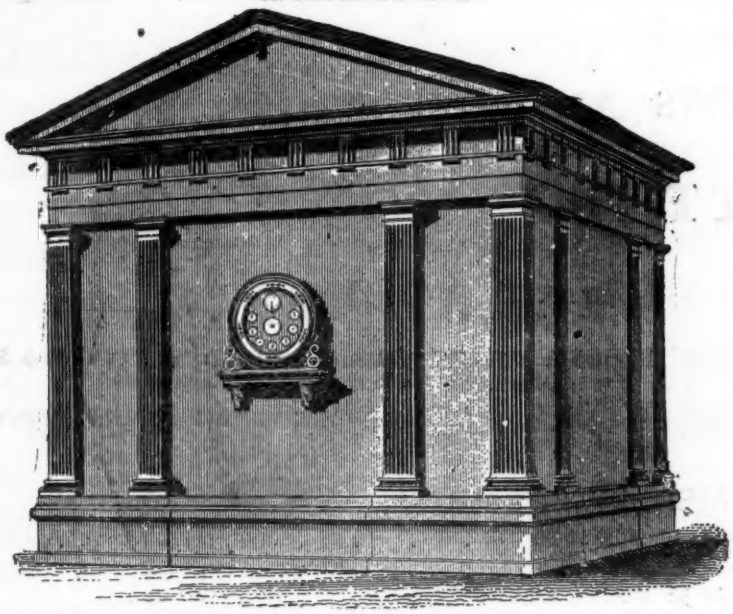
ROUND STATION-METERS,

ON CAST-IRON STANDS.



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GAS COOKING APPARATUS.

WATER-METERS SUITABLE FOR ALL PRESSURES.

Home and Foreign Orders promptly attended to.

All Sizes of CONSUMERS METERS, STATION-METERS, and GOVERNORS generally in Stock.

Orders almost invariably despatched on the day of receipt.

TERMS, &c., ON APPLICATION.

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GAS ENGINEERS,

Gas-Meter, Gas Apparatus, and Gas-Fittings Manufacturers,

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2, KING EDWARD STREET,

NEWGATE STREET, LONDON.

STATION-METERS, GOVERNORS, CONSUMERS METERS, GAS LUSTRES, CHANDELIERS, BRACKETS, &c.,

And every description of Gas-Fittings and Gas Apparatus.

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GAS AND CONSULTING ENGINEER,

19, NORTHUMBERLAND STREET, STRAND, W.C.

MR. ANDERSON advises Companies on all matters connected with the manufacture of Gas and the construction of Works.

PATENTEE and MANUFACTURER of the following Inventions:—

RETORT SETTINGS, heated by tar without the production of smoke.

STEAM-ENGINES and EXHAUSTERS, separately or combined.

FOUR-WAY VALVES, one of which is equal to three ordinary Valves.

STATION GOVERNORS—the Gasholder cannot tilt and cause accident.

BREEZE AND TAR FUEL MACHINE.

A Pamphlet containing Eighteen Illustrations of the foregoing, with letterpress on the construction of Works, post free, 2s. 6d

N.B.—The second edition of this Work, *now ready*, contains Illustrations of the Machine for converting Breeze and Tar into Fuel for heating the Retorts.

"The Author is well qualified to speak authoritatively upon the important subjects to which his pamphlet refers."—*Artisan.*

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HUCKNALL COLLIERY COMPANY

Can offer a CANNEL COAL yielding a large quantity of Gas of superior quality.

Prices and information on application to the HUCKNALL COLLIERY COMPANY, Hucknall Torkard Collieries, near NOTTINGHAM.

POPE & PEARSON'S GAS COAL.—We have now the authority of several of the most eminent Gas Engineers of London in stating that our Coal yields *in practical working over* 10,000 *cubic feet of gas, with an illuminating power of* 16 *candles;* or by the standard burners now used by the London Gas Companies, an illuminating power equal to 17½ candles.

One ton yields 12½ cwt. of good coke. This Coal can be shipped from Hull, Goole, Liverpool, Morecambe, and Barrow.

For further particulars, apply to POPE AND PEARSON, West Riding and Silkstone Collieries, near LEEDS.

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LESMAHAGOW

MAIN SEAM CANNEL COAL.

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Supply the Best Wigan Arley Mine Gas Coal and Nuts; the Best Hand-picked Round Cannel;

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Are prepared to enter into CONTRACTS with

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FOR SUPPLIES OF

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SUPPLIED BY

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Prices Quoted on application.

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WIGAN COAL AND CANNEL,

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AND

Messrs. W. H. BRANCKER & Co.

GAS AND WATER PIPES.

WILLIAM MACLEOD & CO.,

18 & 20, ALSTON STREET, GLASGOW.

CAST-IRON GAS AND WATER PIPES.

MALLEABLE IRON TUBE FOR GAS, WATER, AND STEAM.

AGENTS FOR THOMAS GLOVER & CO.'S

PATENT DRY GAS-METERS.

DELIVERY F.O.B. ON CLYDE.

Lists on application.

WILSONTOWN GAS COAL.

This Coal bears a close resemblance to the Lesmahago seam. It has a first-class Coke, equal to the Lesmahago, and greater in quantity, and 10,538 Cubic Feet of 33·2 Candle Gas.

For rail in Scotland, or shipped at Glasgow, Leith, or Granton.

ANALYSIS AND REPORT

ON

CLIMPY TRIPPING COAL,

FOR GAS PURPOSES.

The results of this analysis, as shown below, were got from actual working, and we have therefore the utmost confidence in placing it, along with that annexed, before you.

COMMERCIAL RESULTS.

Gas per ton of Coal—temperature 60°—barometer 30 inches	10,200 cubic feet.
Coke per ton of Coal	1,400 lbs.
Durability of one cubic foot of the gas, by jet of 5-inch flame	48 min. 24 sec.
Illuminating power in standard candles	14·9

REMARKS.

Being well acquainted with Durham and Northumberland Coals, I have no hesitation in saying that "CLIMPY TRIPPING" is superior to any (containing, besides, a greater proportion of pieces from 7 to 14 lbs. weight), with far less impurities for purification, more gas, and coke equal in calorific power. It has a large mixture of cannel nuts, which accounts for the good quality of the gas, at our photometer in town, 1000 yards from the works.

It is also a very superior Coal for mixing with oils, as by Mackenzie's patent; or with acid tar, or tar oil, shale grease, or other refuse from paraffin-works, as by system of Mr. Scott, of Musselburgh, or Mr. Foster, Portobello, the Coal being easily crushed.

Below are the results realized by myself, when mixed with acid tar from paraffin work, received by me in a solid state, having been run on to very fine dross. My charges were 2 cwt. tripping and 28 lbs. of acid tar, each retort, running six hours; with lighter charges I get more gas, but not so good quality, or so much coke.

Gas per ton of Coal	10,800 cubic feet.
Coke per ton of Coal	1,540 lbs.
Durability of one cubic foot of gas, by jet of 5-inch flame	58 min. 28 sec.
Illuminating power in standard candles	27·29

The first truck received being tried with very light charges (unmixed), and running five hours, I got 10,500 cubic feet of 14-candle gas; and I am confident, practical managers, with good retort-fittings (mine being very inferior), and exhausters at work, as I have seen generally at home and abroad, will take 11,000 feet of 13-candle gas from it. My retorts are 8 feet × 2 feet × 14 inches, D shape, heavy dip, and no exhauster.

These remarks of mine you may perhaps think rather lengthy, but they will be the more intelligible to any manager inquiring for Climpy Tripping.

L. MONK,
Engineer and Manager.

Lanark Gas-Works, April 20, 1874.

GAVIN PAUL,

WILSONTOWN GAS COAL WORKS & CLIMPY COLLIERY,

BY CARNWATH, N.B.

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GAS COAL MERCHANT,

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Delivery per Rail to any Part.

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ALL CLASSES OF

ENGLISH, SCOTCH & WELSH CANNEL COALS.

CANNEL COAL.

COPPA COLLIERY, MOLD,

Beg leave to call the attention of Gas Companies to the superior quality of their

CANNEL FOR GAS-MAKING PURPOSES.

This Cannel produces in actual working, in iron retorts, 9200 cubic feet of 35-candle gas, and upwards of 11 cwt. of coke, and in clay retorts will produce 11,500 cubic feet of 25·9-candle gas.

Ports of shipment—Birkenhead or Connah's Quay.

Waggons supplied for delivery by railway to any part of England or Wales.

For particulars, prices, and rates of freight, apply to The Coppa Colliery, Mold, FLINTSHIRE.

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The Subscriber is prepared to contract for the supply of all the principal SCOTCH CANNEL COALS. Prices and Analyses of the various Coals will be forwarded on application.

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Established 1840.

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RUSSEL'S BOGHEAD.

MUIRKIRK, No. 1, CANNEL

Yields 11,600 cubic feet of 34·3-candle gas per ton, and 10 cwts. of excellent coke, containing only 5 per cent. of ash.

MUIRKIRK, No. 2, CANNEL

Yields 10,700 cubic feet of 32·77-candle gas per ton, and 9½ cwts. of coke, containing 11 per cent. of ash.

OLD WEMYSS CANNEL

Yields 12,550 cubic feet of 33-candle gas per ton.

Prices and full Analyses on application.

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THORNCLIFFE IRON-WORKS AND COLLIERIES,

NEAR SHEFFIELD,

STRONGLY RECOMMEND A TRIAL OF THEIR

CELEBRATED SILKSTONE GAS NUTS.

Analysis by F. J. EVANS, Esq., Chartered Gas Company, Horseferry Road, Westminster:—

(COPY.)

	Cubic Feet of Gas per Ton of Coal.	Illuminating Power in Candles.	Coke per Ton of Coal used.	Ash in Coke, per Cent.	Sulphur in Coal, per Cent.
Silkstone Nuts . . .	10·800	15·85	12·66 cwt.....	6·0	0·69

NOTE.—The illuminating power of the gas was tested by the standard burner now used in London by the Gas Referees, under the City of London Gas Act, 1868.

Horseferry Road, Westminster, March, 1870. (Signed) F. J. EVANS.

These Nuts are extensively used by various Gas Companies throughout the Kingdom, who bear strong testimony to their value.

APPLICATIONS FOR PRICES, &c., TO BE SENT DIRECT TO THE COLLIERY, AS ABOVE.

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DRY GAS-METERS,

PRIZE MEDALS. (INVENTED & PATENTED IN 1844,) PRIZE MEDALS.

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STATION-METERS AND GOVERNORS.

STREET-LAMP REGULATORS.

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of the most perfect description for all purposes relating to Gas.

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THE UNVARYING WATER-LINE GAS-METERS,

IMPROVED DRY GAS-METERS, in Cast-Iron or Tin-Plate Cases;

STATION-METERS, ALL SIZES, up to 15 feet Square, with PLANED JOINTS;

Experimental Meters, Photometers, Pressure-Gauges,
Governors, Test Holders, &c., &c.

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SMALL GAS COOKING STOVE, No. 133, 12 in. wide. £1 15s.

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HOLBORN WORKS, SMART'S BUILDINGS, HIGH HOLBORN,

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AND

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COPY TESTIMONIAL.

NORTHAMPTON GASLIGHT COMPANY,

Northampton, May 14, 1874.

Messrs. Billing and Co.,

Gentlemen,—We have sold a large number of your Gas Cooking Stoves during the last 12 months, and they have, without exception, given the greatest satisfaction. I consider your Stove the best I have seen.

I remain, yours obediently,

JOHN EUNSON, JUN., Manager.

90, Hatton Garden, London.

London: Printed by WILLIAM BOUGHTON KING (at the office of Clayton and Co., 17, Bouverie Street, Fleet Street); and published by him at No. 11, Bolt Court, Fleet Street, in the City of London.—Tuesday, July 28, 1874.